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ABSTRACT

This guide was developed to assist teachers in achieving goals related to the development of computer awareness in students in grades 4-6 in the Canadian province of Manitoba. An overview of the program describes a set of basic concepts, skills, and attitudes relating to computer technology, and provides information on activities that can be used in teaching these concepts, skills, and attitudes. The computer awareness program itself is divided into five units: (1) Getting Started, which introduces the computer and the basic skills necessary to operate the computer; (2) What Is a Computer, which provides students with information about the components of the computer; (3) How Computers Have Developed, which exposes students to the development of calculating aids, from finger calculators to modern computers; (4) How To Make Computers Work for You, which leads students from linear sequencing skills to procedural thinking, with students learning to control the computer through LOGO; and (5) Computers in Our Lives, which explores the home, school, and community environments with respect to microchip technology. The text is supplemented by various illustrations and diagrams, and a resource section provides lists of 29 printed sources and the names and addresses of 16 suppliers. (EW)

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1985

4~6 computer awareness

interim guide

manitoba education

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4-6 computer awareness

interim guide

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program overview

RATIONALE

This guide was developed to assist teachers in achieving the goals related to the development of computer awareness in elementary students. For purposes of this document the definition of "computer awareness" will be that proposed by the Manitoba Computer Awareness Task Force (K-12) in March, 1982. The Task Force considered that computer awareness includes:

- an understanding of what computers can and cannot do;
- interaction and communication with computers;
- using computers to solve problems; and
- using computers in the educational setting.

The underlying aim of computer awareness is to promote an understanding of the uses of computer technology in the home, in the school, and in the community as well as a knowledge of some of the effects of this technology.

The development of the Manitoba K-9 Computer Awareness curriculum was the result of both the philosophical support of the Computer Awareness Task Force (K-12) and the expressed need from within the educational community. This need was demonstrated by the development of school initiated computer awareness programs. In turn, these school initiated programs were the response of the educational community to the need expressed by students and parents to emphasize a more adequate preparation for a society which is a user of computer technology.

The 4-6 Computer Awareness guide is one part of a three-part K-9 Computer Awareness program intended to provide the teacher with enough information to establish introductory computer awareness for all students in these grades. The K-9 program has been divided into three guides, namely, K-3, 4-6, and 7-9.

Consider 4-6 Computer Awareness to be:

1. optional rather than mandatory,
2. a series of five units requiring 15-20 hours for each of the three years,
3. taught using either an integrated or a discrete approach although all pilot teachers emphasized the benefits of integration,
4. a scope and sequence of objectives divided according to levels 1, 2, 3 and according to expected student mastery (introduction, expansion, proficiency), as well as
5. a sampling of activities suggested for use at the various levels.

Computer awareness should not be interpreted as the specialization of one subject area or of one group of educators. Rather, all classroom teachers should be encouraged to become involved in using computer technology so that it can achieve its appropriate place in serving education as a tool to aid student learning and instruction in the classroom.

The 4-6 Computer Awareness guide addresses the diverse backgrounds of both students and teachers as well as the various types and quantities of computer hardware and courseware. Many of the objectives outlined in this document can be achieved without the use of a computer. However, hands-on activities are highly recommended in order to provide concrete experiences and to increase motivation.

The phenomenon of increasing knowledge and sophistication of students with respect to educational computing in general and to computer awareness in particular is anticipated to result in the need for revision on a frequent and on-going basis.

Educators might still ask, "But why teach computer awareness? What part does computer awareness play in the elementary curricula?" One valid and overwhelmingly compelling reason for including computer awareness is that it becomes the initial step in the students' control over and use of a powerful and emerging technology.

GOALS

Based on the computer awareness model for Manitoba as defined in the Report of the Computer Awareness Task Force (K-12) computer awareness for grades K-9 has been designed to promote familiarity with computers, ability to interact and to communicate with computers, and understanding of computer applications and implications within society.

In support of these aims, K-9 Computer Awareness has the following specific goals:

1. To become familiar with the computer as part of the learning environment.
2. To become comfortable interacting with a computer.
3. To demonstrate appropriate care and handling of computer systems.
4. To acquire a knowledge of the components of a computer system.
5. To appreciate the development of computing devices as they increase in complexity and capability.
6. To become aware of possible and probable future uses and development of computers.
7. To develop skills in creative problem-solving.
8. To achieve the ability to solve problems through the use of educational computing.
9. To appreciate the extensive use of computer technology in homes, schools, local communities, and society in general.
10. To become aware of the advantages and limitations of computer technology.

DESCRIPTION AND DEVELOPMENT

THE GUIDE

The Program Outline section of the 4-6 Computer Awareness guide describes a set of basic concepts, skills and attitudes related to computer technology and arranges these in a three-column format:

1. The objectives, outlined on the left-hand side of these pages, identify those concepts, skills, and attitudes central to the achievement of computer awareness in the intermediate grades. Each objective is followed by the desired expectation of student knowledge or mastery. "Introduction" implies first exposure, "Expansion" indicates an extension to new areas built on knowledge gained during a previous exposure in that same or a preceding school year, and "Proficiency" denotes an appropriate student competence.

2. Additional information for the teacher has been included in the middle of these pages under the heading "Notes and Explanations." Details relating to background knowledge, to intended scope, and to classroom activities have been included under this heading. Activities are either in the form of suggestions which the classroom teacher may develop according to student needs (these suggestions are inset and starred *) or in the form of fully developed activities found in the Activities section of the guide. Fully developed activities are provided courtesy of committee members, pilot teachers and other interested educators.

3. All developed activities are coded in the third column as follows:

    II-4-6
    LA/Sc

    II-4-6 indicates that the activity is part of Unit II, accompanies Objective 4 and is the 6th developed activity for that objective. Integration information is found beneath this coding. In the example, LA/Sc indicates that Activity II-4-6 could be integrated with either Language Arts or Science. The teacher could then refer to the 4-6 Computer Awareness Integration Chart found in the Integration section of this guide to determine the specific concepts/skills in the Language Arts or Science curricula with which that particular activity could be integrated.

    Experience gained during the pilot program suggests that teachers used the guide in two distinct ways. Some chose to follow the sequence of units and objectives as presented. Others preferred to select and to combine objectives from a number of units in an attempt to meet the particular needs of their students. The second method provided greater opportunity for integration of computer awareness with other intermediate grade activities. For this reason, it is necessary to emphasize that the 4-6 Computer Awareness units need be taught neither in a block nor in the sequence presented in this guide.

UNIT DESCRIPTIONS

In order for elementary students to become comfortable as computer users it is necessary to provide ample opportunity for "hands-on" experience with a microcomputer wherever possible throughout the five units which comprise 4-6 Computer Awareness.

Unit I: GETTING STARTED! 10%

This unit is intended to help students become familiar with the procedures needed for getting the computer up and running in a classroom or school. Do's and don'ts with respect to care, maintenance, and organization are emphasized. A first "hands-on" experience with the computer is suggested.

Unit II: WHAT IS A COMPUTER? 20%

This unit concentrates on the computer; what it is, and how it works. Computer components and processes will be introduced using a variety of concrete activities. Emphasis is to be placed on the input-processing-output sequence. Modern calculators, electronic games, and toys will be compared to and contrasted with the computer. Students are to explore the capabilities and limitations of the computer. Hands-on time with quality educational courseware which integrates with elementary curricula is a key component.

Unit III: HOW COMPUTERS HAVE DEVELOPED 10%

This unit is intended to expose students to the development of calculation aids from finger calculators to modern computers. Emphasis is placed on the increase in complexity and capacity of calculation aids but not on formal history. It is recommended that students be provided with "hands-on" experience using devices such as the abacus, slide rule, mechanical calculator, electronic calculator, and electronic learning aids as well as the microcomputer. After students have investigated past and present technological developments, they should spend time discussing and predicting future trends.

Unit IV: HOW TO MAKE COMPUTERS WORK FOR YOU 40%

This unit leads students from linear sequencing skills to procedural thinking. Students learn to control the computer using Logo. Development begins with pre-Logo activities involving concrete devices and leads to experimentation using the "screen turtle" in immediate mode. After appropriate hands-on experimentation, students begin to recognize the need to create, edit and save simple Logo procedures. As the need arises, students create procedures which may be used as subprocedures in top-down problem-solving. The techniques of repetition and recursion are introduced to simplify/enhance Logo procedures.

Unit V: COMPUTERS IN OUR LIVES 20%

Modern technology is affecting all aspects of our lives. This topic is intended to have students investigate the home, school, and community environment with respect to microchip technology. Similarities and differences between real and fictional computers are addressed.

TIME ALLOTMENT

The K-9 Computer Awareness program has been designed as a series of three optional guides developed for the following grade levels and requiring the identified contact times.

Grade Levels	Contact Time
K-3	10-15 hours per year
4-6	15-20 hours per year
7-9	20-25 hours per year

The recommended contact time for 4-6 Computer Awareness should be distributed over the units in the following way:

- Unit I: Getting Started! 10%
- Unit II: What Is A Computer? 20%
- Unit III: How Computers Have Developed 10%
- Unit IV: How To Make Computers Work For You 40%
- Unit V: Computers in Our Lives 20%

OBJECTIVES FOR 4-6 COMPUTER AWARENESS

	Level 1	Level 2	Level 3
I. GETTING STARTED!			
The student should be able:			
1. to explain and to show how to switch on a microcomputer;	Proficiency		
2. to explain and to show how to care for a microcomputer and its peripherals;	Proficiency		
3. to demonstrate simple trouble-shooting techniques;	Introduction	Expansion	Proficiency
4. to demonstrate the use of the microcomputer keyboard in immediate mode.	Introduction	Expansion	Expansion
II. WHAT IS A COMPUTER?			
The student should be able:			
1. to differentiate between hardware devices and software storage media;	Introduction	Expansion	
1. to identify the major parts of a computer system and to explain the basic operation of each part in relation to the input-processing-output sequence;		Introduction	Expansion
3. to recognize that people control what computers do;	Introduction	Expansion	Expansion
4. to identify similarities and differences among computers, calculators, and electronic games;	Introduction	Expansion	

	Level 1	Level 2	Level 3
5. to recognize that computers are best suited to tasks requiring speed, accuracy, repeated operations, and the storage of large quantities of data;	Introduction	Expansion	
6. to use prepared software programs in a microcomputer.	Introduction	Expansion	Expansion
III. HOW COMPUTERS HAVE DEVELOPED			
The student should be able:			
1. to identify and to describe early computing devices which led to the development of the modern computer;			Introduction
2. to recognize the four generations of computer development;			Introduction
3. to describe possible future technological developments based upon recent trends.			Introduction
IV. HOW TO MAKE COMPUTERS WORK FOR YOU			
The student should be able:			
1. to identify and to sequence steps needed to accomplish a task;	Introduction	Expansion	Expansion
2. to understand that a computer language must be used to communicate with a computer;	Introduction	Expansion	Expansion
3. to relate the Logo turtle's language to human movement;	Introduction	Expansion	

	Level 1	Level 2	Level 3
4. to relate the Logo turtle's language to manipulation of a "concrete turtle";	Introduction	Expansion	
5. to relate the Logo turtle's language to the manipulation of a robotic device;			Introduction
6. to devise, record, test, and revise a plan for the creation of a design using the Logo "screen turtle" in immediate mode;	Introduction	Expansion	Expansion
7. to create, edit, and save procedures, subprocedures, and superprocedures using Logo or a Logo-like language;	Introduction	Expansion	Expansion
8. to use repetition to simplify and to enhance Logo procedures;	Introduction	Expansion	Expansion
9. to create recursive Logo procedures.		Introduction	Expansion

V. COMPUTERS IN OUR LIVES

The student should be able:

1. to recognize the use of microchip technology:			
a) in the home, b) in the community, and c) in recreation;	Introduction	Expansion	
2. to identify capabilities and limitations of the computer;			Introduction
3. to describe similarities and differences between computers in fiction and computers in reality.		Introduction	Expansion

program implementation

HARDWARE

The 1983/84 Survey of Computer Hardware in Manitoba schools indicated that approximately three quarters of all Manitoba schools use computers in the teaching and learning process. The annual increase in the amount of computer hardware in Manitoba schools results in a corresponding decrease in the provincial student-to-computer ratio which stood at 60:1 for 1983/84.

As a result of pilot teacher observations it is recommended that 4-6 Computer Awareness classes have access to at least one microcomputer with a high resolution colour monitor, disk drive, graphics tablet, and printer. The colour monitor is essential for effective use of software which is colour-dependent. The disk drive is essential for quick, easy, and reliable loading of software. The graphics tablet allows the students access to the microcomputer without using the keyboard. The printer might be shared within the school but should be available to allow the production of hard copies of student work. In addition, the microcomputer should be capable of producing both upper and lower case print as appropriate for students.

Other hardware devices that would aid in the successful implementation of 4-6 Computer Awareness include robotic devices such as the Tasman Turtle, Turtle Tot, or Big Trak and alternative input devices such as the trackball or the mouse. The teacher should be aware that special software may be required to operate these devices.

The placement of computer hardware within the school depends upon how many microcomputers are available and upon the need to share these. Placement strategies should remain flexible to accommodate the changing needs for access to microcomputer hardware within an elementary school. Some strategies include:

1. Microcomputer(s) Permanently in the Classroom.
   Pilot teachers have indicated that the ideal situation would be to have at least one microcomputer in the classroom at all times.

2. Microcomputer(s) Moved into and out of the Classroom.
   The most common means of sharing with other teachers is to have the microcomputer system move from room to room. The system is placed on a wheeled cart which should have a raised edge to prevent components being knocked off accidentally.

3. Microcomputer(s) in a Central Area.
   Although the physical location of the computer(s) within the elementary classroom was preferred by the pilot teachers, some schools may place their microcomputer(s) in a central area. This central area could be the library, a "computer classroom" or some other supervised area.

GENDER EQUITY

The use of microcomputers in the schools has been seen as a potential equalizer of high-tech opportunity for both girls and boys. This potential can only be realized if teachers balance their choice of educational courseware; if teachers provide opportunities for positive computing experiences for both sexes; and if both female and male students learn to use the computer as a tool.

Teachers of 4-6 Computer Awareness should ensure that computer activities provide a positive experience for both boys and girls and that students of both sexes have equal access to the computers in the classroom. Procedures for ensuring that every student gets a turn, that pairs of students working together learn to share equally, that aggressive students do not push aside more hesitant ones, and that computer access is not provided only for the gifted or to the slower learner are all important considerations. In addition, female Computer Awareness teachers have an excellent opportunity to provide a positive role model for students in their classes.

Students who learn to use the microcomputer as an applications tool to create graphic, musical, and written compositions or who learn to program the microcomputer in the non-threatening environment of the Logo language, are placing themselves in control of their computing experience. Teachers of 4-6 Computer Awareness should ensure that both girls and boys have these opportunities and that classroom computing experiences portray the microcomputer as a general purpose, gender-neutral, intellectual tool. In addition, materials used in 4-6 Computer Awareness should not reinforce sexual stereotypes, nor should they contribute to the image of the computer as being male or for males only.

Teachers will find in taking the precautions discussed earlier that boys and girls will use computers equally in the intermediate grades and at the same time will lay the foundations for gender equity in future computer studies.

SPECIAL NEEDS

The mainstreaming of students with special needs into the elementary classroom necessitates special considerations on the part of educators. Through the use of individualized computer-based courseware, educators can accommodate many of these special considerations. The 4-6 Computer Awareness interim guide considers three general classes of special needs students; the slower learner, the handicapped/disabled, and the gifted.

The slower learner should be encouraged by the teacher to join in classroom computer awareness activities. However, provision should be made for the slower learner to have additional hands-on time with appropriate courseware. The use of quality courseware can be highly motivating for the slower learner by presenting basic facts in new and different ways. Through random selection or random generation, a single piece of courseware can present similar yet different problems or questions each time it is used. The immediate feedback and interaction of the courseware can be used to keep the student on-task and engaged for longer periods of time than that achieved using traditional methods.

The teacher should find that a high degree of individualized instruction can be provided for the slower learner through the use of educational courseware. The teacher may be able to customize the courseware by setting the limits for problems to be presented to the student as well as the level of mastery to be achieved. Success at an appropriate level of difficulty may lead to increased personal self-esteem and motivation.

The handicapped/disabled student should be encouraged to participate in the class activities of 4-6 Computer Awareness as much as possible given the nature of the handicap/disability. Modifications may have to be made in order to allow the handicapped/disabled student access to the microcomputer hardware.

Various devices are available which adjust the kind of input accepted by the microcomputer. These include plexiglass masks which cover the keyboard to prevent accidental keystrokes by students lacking in fine motor control or coordination. Touch sensitive screens, joysticks, head sticks, braille keyboards, voice-activated input devices, trackball devices, aspiration devices, Bliss symbolic keyboards, and button boxes are other examples of tools which can make the microcomputer accessible to the student with a handicap/disability.

On the other hand, various devices are available which adjust the nature of the output produced by the microcomputer. These include magnifying devices, printers which produce enlarged text for the visually impaired, and speech synthesizers or Braille embossers for the blind student.

The achievement of control over a microcomputer may improve the self-image of the handicapped/disabled student. The teacher should consider training such a student to use the microcomputer before introducing it to the rest of the class.

The microcomputer and appropriate educational courseware can be used to enrich the learning environment of the gifted student. Quality courseware can challenge a gifted student to employ creative problem-solving techniques involving hypothesis, analysis, synthesis, and deduction. Electronic databases can assist the gifted student in the organization, manipulation and retrieval of information. Word processing software can encourage the students to revise and edit written work, producing a clean copy after rewriting is complete. Tutorial courseware can enhance learning experiences in a lateral direction, expanding on concepts or skills which have been covered previously. Computer simulations can allow the gifted student to become immersed in life-like situations and to experiment with real-life processes without leaving the classroom. Graphics-based computer languagess can be used by the student to explore "turtle" geometry and to begin to develop the top-down technique of problem solving.

STUDENT EVALUATION

Generally, evaluation is conducted to determine how well a student has mastered the knowledge and has acquired the skills and attitudes contained within a program of studies. On this basis, a meaningful evaluation of student participation in 4-6 Computer Awareness must be based on student exposure to the particular objectives found within this guide. At the elementary level it is recommended thata student be evaluated informally ratherthan byusing more formal techniques.

One informal method of evaluation is teacher observation. The teacher may observe the extent to which a studentparticipates in class discussions, the degree of studentinitiative in researching and sharing information and materials, and the ability of a student to verbalizeconcepts and skills.

Such observation could seek answers to the following questions:

- Does the student feel comfortable with and enjoy using a microcomputer?
- Is the student able to work independently on a microcomputer?
- Does the student cooperate with other students in the use of a microcomputer?
- Does the student engage in discussion of computer-related topics?

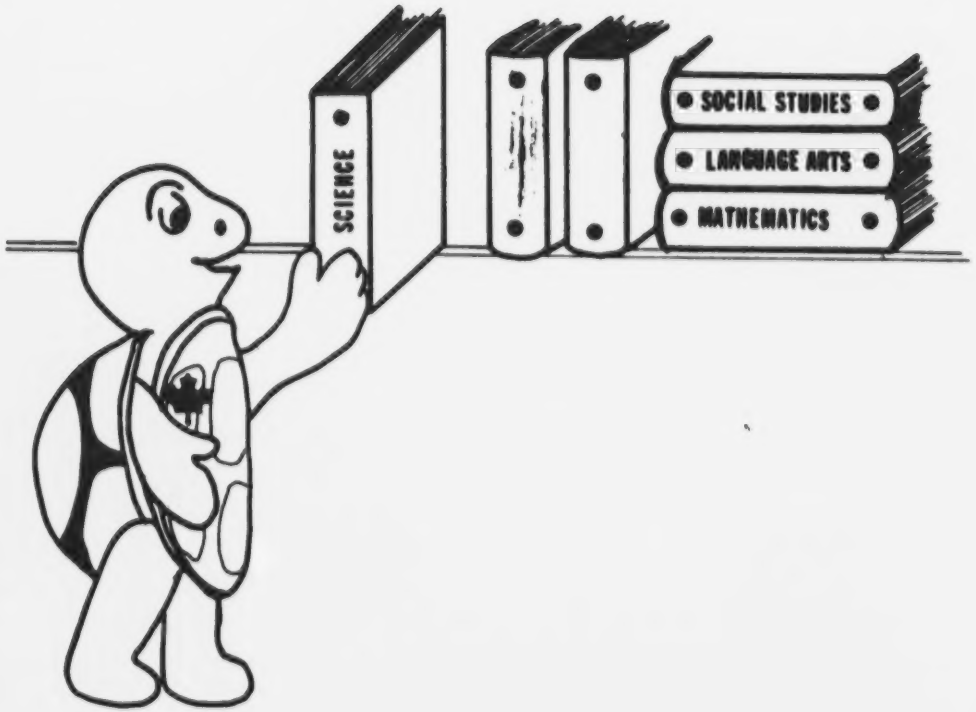
. Does the student demonstrate an understanding of computer use in the home, school, and community?

Another method of student evaluation is the anecdotal record. The anecdotal record contains short notes by the teacher recording a change in attitude, the development of understanding, as well as evidence of the application of knowledge to new situations. The teacher can conduct short discussions with individual students or small groups in order to acquire this information.

Another useful evaluative tool is a student file which contains a collection of work gathered over time. Such a file may indicate important changes in the knowledge, skills, or attitudes of the student with respect to computer technology. The information in the student file can be reported to parents or displayed during a parent's visit to the classroom.

It is recommended that computer awareness activities be integrated into core subjects of the elementary curricula. Where such integration occurs, evaluation should be in the core subject rather than in computer awareness.

integration



INTEGRATION

It is recommended that 4-6 Computer Awareness be integrated with other elementary curricula. The 4-6 Computer Awareness Integration Chart was prepared by committee members to assist teachers wishing to develop an integrated thematic approach in the area of computers. Such an approach allows the content and concepts of a number of subject areas to be integrated with computer awareness.

The intermediate grade Language Arts, Mathematics, Science, and Social Studies guides have been examined to determine which concepts and skills are taught at each level. The skills and concepts of the Computer Awareness activities were matched with those from the intermediate grade guides in the form of the 4-6 Computer Awareness Integration Chart. Teachers who require an indepth explanation of the concepts or skills identified in the chart should refer to the appropriate subject area guide for clarification.

The 4-6 Computer Awareness Integration Chart is a matrix of the subject areas and the Computer Awareness activities identifying where integration can occur. Each activity is listed vertically along the left-hand side of the page according to code, title, and level.

The subject areas of Language Arts, Mathematics, Science, and Social Studies follow across the top. Where integration of a specific Computer Awareness activity occurs with a particular subject area, the concept or skill is identified in the matrix. For example, Activity II-2-4, Computer Input-Output, is an activity which matches with Language Arts in the area of "discussion" and which matches with Science in the areas of "recording" and "comparing." The teacher can use such information to plan an integrated lesson in Language Arts or Science.

Three special terms appear in the 4-6 Computer Awareness Integration Chart. The term "hands-on", abbreviated H-o, refers to the fact that students are required to use a computer to achieve the desired outcomes. The term "teacher utility", TU, means that particular activity has been provided to aid the teacher in demonstrating a concept for students. These utilities are not intended to be used directly by all students. The term "Logo", Lo, identifies those activities involving a graphics-based, problem-solving, computer language.

Discussion with pilot teachers revealed that the use of integration for 4-6 Computer Awareness is the most viable method of including computer-based content in the elementary curricula. Integration provides a powerful tool which assists classroom teachers in providing computer awareness in their own classrooms. Using this approach, teachers do not have to rely on outside "experts" or resource persons in order to implement 4-6 Computer Awareness successfully.

4-6 COMPUTER AWARENESS INTEGRATION CHART

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
I-1-1	Computer Reminders	1	.following directions				.teacher utility
I-1-2	"Booting" Microcomputers	1	.reading comprehension .sequencing				
I-2-1	Respect and Responsibility	1	.oral language .visual communication				
I-2-2	Dealing with Diskettes	1	.graphics display .comprehension				
I-2-3	Caring for Cassettes	1	.graphics display .comprehension				
I-2-4	Discovering Diskettes	1	.following directions .composing and writing				
I-2-5	Fragile, Handle With Care	1	.visual communication .application				
I-4-1	Microcomputer Keyboards	1	.visual identification				.teacher utility

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
I-4-2	Keyboard Challenge	1					.hands-on
I-4-3	Computer Calculating	2		.arithmetic operations			.hands-on
II-1-1	Classifying Hardware and Software	1	.comprehension		.classification		
II-1-2	Searching for Words	1	.spelling				
II-1-3	Micro-Math	1		.word problems .addition .subtraction			
II-1-4	More Micro-Math	2		.word problems .multiplication .division			
II-2-1	What's In A Computer?	3	.dramatization				
II-2-2	Input, Process, Output	2	.comprehension				
II-2-3	The Five Senses	2			.observation .recording		
II-2-4	Computer Input/Output	2	.discussion		.recording .comparing		

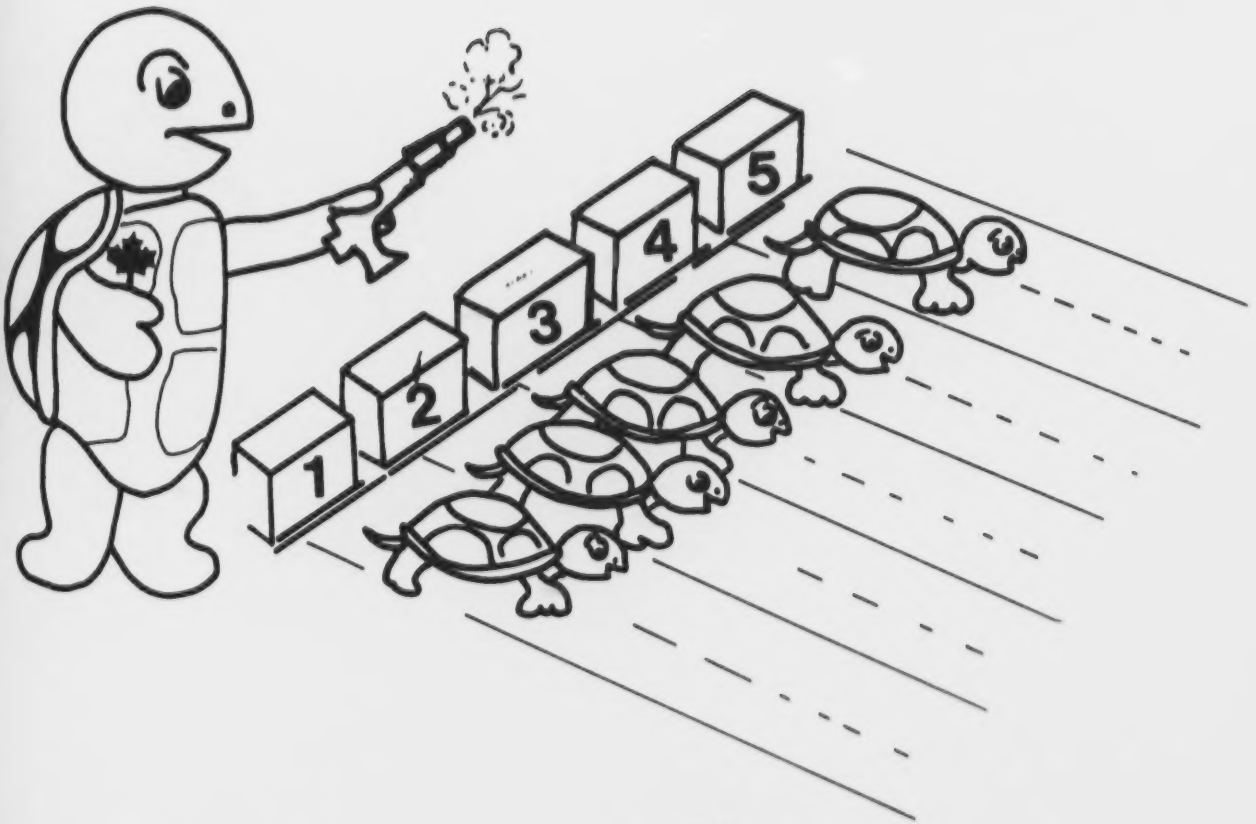
ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
II-3-1	Danny Dunn and the Homework Machine	3	.knowledge .comprehension .application .analysis .synthesis .evaluation				
II-5-1	Computer Trivia	1	.interpret meaning .comprehension .notetaking				
III-1-1	Computer History Word Search	3	.spelling				
III-1-2	Who Am I?	3		.coordinate graphing			
III-3-1	Is This Coming?	3	.prediction .cartooning			.changing societies	
IV-1-1	Putting Things in Order	1	.sequencing				
IV-1-2	Socks and Shoes	2	.analysis .sequencing				
IV-1-3	Getting Ready	3	.analysis .sequencing				
IV-4-1	Stuffy Turtles	1					.Art .Logo .teacher utility

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
IV-4-2	Cloth Turtle	2					.Art .Logo .teacher utility
IV-6-1	Turtle Turning Wheel	1-3					.Logo
IV-6-2	Learning With Logo	1-3					.Logo .teacher utility
IV-6-3	Turtle's First Step	1					.Logo .hands-on
IV-6-4	Turtle's Compass	1				.mapping	.Logo .hands-on
IV-6-5	Turtle Travels	1					.Logo .hands-on
IV-6-6	Rainbow Turtle	1					.Logo .hands-on
IV-6-7	Sherlock Turtle	2					.Logo .hands-on
IV-6-8	Transparent Turtle	3					.Logo .teacher utility
IV-6-9	Turtle Adventure Game	3					.Logo .hands-on .teacher utility

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
IV-7-1	Pencil Turtle	1-3					.Logo
IV-7-2	Turtles On Safari	1					.Logo .hands-on
IV-7-3	Turtles At Work	1					.Logo .hands-on
IV-7-4	Manitoba Turtles	2				.mapping	.Logo .hands-on
IV-7-5	Places In Manitoba	2				.mapping	.Logo .hands-on
IV-8-1	Turtles, Turtles and More Turtles	1					.Logo .hands-on
IV-9-1	Reflecting on Recursion	2					.Logo .teacher utility
IV-9-2	Super Turtles	2					.Logo .teacher utility
V-1-1	Opinionnaire	1				.communication	.teacher utility
V-1-2	A Computer Play in 3 "Bytes"	1	.dramatization .oral language			.interaction in the community	
V-1-3	Questionnaire Questions	2	.oral language				.teacher utility

ACTIVITY	TITLE	LEVEL	LANGUAGE ARTS	MATHEMATICS	SCIENCE	SOCIAL STUDIES	OTHER
V-1-4	Sample Student/Parent Survey	2	.communication	.graphing	.interpreting data	.interaction in the community	
V-1-5	Sample Business Survey	2	.communication	.graphing	.interpreting data	.interaction in the community	
V-1-6	GAMES, Games, games	1	.communication				
V-2-1	People Can...Cannot... Computers Can...Cannot...	3	.oral language .listening				
V-2-2	DECISIONS, decisions	3	.classification .analysis/ synthesis				
V-3-1	SKREEEK! SQUONNNK! Here Come the Robots	2	.comprehension				
V-3-2	Compu Connie	3	.comprehension				
V-3-3	PEM* Control	3	.comprehension				

program outline



UNIT I GETTING STARTED!

This unit is intended to help students become familiar with the procedure needed for getting the computer up and running in a classroom or school. Do's and don'ts with respect to care, maintenance, and organization are emphasized. A first "hands-on" experience with the computers is suggested.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
The student should be able:		
1. to explain and to show how to switch on a microcomputer; (Level 1-Proficiency)	See the appropriate microcomputer manual for details concerning cable connections and positions of ON/OFF switch(es).	I-1-1 LA/TU
	User Guides for Apple II, Commodore PET, and TRS-80 Model III microcomputers have been prepared by the Educational Technology Program and are available at printing costs from the Educational Technology Centre or the Manitoba Text Book Bureau. TITLE APPLE II USER'S GUIDE COMMODORE PET COMPUTER USER'S GUIDE TRS-80 MODEL III USER'S GUIDE	
	Switching on a microcomputer is often called "Booting" which refers to the process of "picking up the computer by its 'boot straps' " or of getting the computer up and running.	I-1-2 LA
2. to explain and to show how to care for a microcomputer and its peripherals; (Level 1-Proficiency)	"Peripheral" refers to any input/output device connected to the microcomputer by wire or cable. For example, cassette drive, disk drive, printer, etc.	

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	* Establish "house rules" that will ensure safety and respect for the entire microcomputer system.	I-2-1 LA

Suggestions for Computer Care

1. While plugging in or unplugging the computer, all switches should be in the OFF position.

2. While the computer is OFF, the disk drive door should be in the OPEN position.

3. Substances such as food, drink, or dust must be kept away from the computer and its various peripherals.

4. While the disk drive light is on, the diskette should neither be inserted nor removed.

5. Diskettes are sensitive to dust, heat, cold, food, and bending. They are fragile and must be handled with care.

6. If the system (computer and accessories) is mobile, establish a procedure for moving which will ensure minimal risk of damage. Having the system permanently fixed on a mobile table or cart is recommended. Ensure that all connections are secure against pulling or bending. The pins in connectors are easily damaged.

Suggestions for Computer Manners

1. Have respect for another student's computer time.

2. If a problem arises while working on the computer, wait patiently for your teacher.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

3. Movement to and from the computer should take place with as little disruption as possible.

4. Students working at the computer are responsible for all other class work assigned during their computer time.

5. The computer is not a toy and should be used in a responsible manner.

Activity suggestions:

* Ensure that students have an opportunity to develop and/or to discuss rules for appropriate care of diskettes/cassettes. Refer to Activitiy I-2-2 for some suggested rules. Many of the DO's and DONT's also apply to cassette tapes. — I-2-2 LA

  Note: The terms "floppy disk," "diskette," and "disk" may be used interchangeably. — I-2-3 LA

* The activity "Discovering Diskettes" (I-2-4) is best done in two parts. First, show students how an actual diskette is constructed by taking a damaged/surplus one apart. Discuss the mechanical operation of a diskette and how information is stored on and retrieved from it. Secondly, students could construct a diskette and its jacket out of construction paper using the given patterns. — I-2-4 LA, I-2-5 LA

* A poetry or prose lesson could be developed using rules on "Care of Cassettes/Diskettes" as a topic.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

* Poetry modelling using a common frame, such as a nursery rhyme, could be developed. For example, model the nursery rhyme "Mary Had a Little Lamb" as shown below:

Original Poem	Parody Poem
MARY HAD A LITTLE LAMB	ROUND AND ROUND THE DISK WILL GO
WHOSE FLEECE WAS WHITE AS SNOW	INSIDE OUR DEAR DISK DRIVE
AND EVERYWHERE THAT MARY WENT	BUT KEEP THE DISK FROM HEAT AND SNOW
THE LAMB WAS SURE TO GO.	AND LONGER IT SURVIVES.

Other poetry forms such as the limerick, rhyming couplet, cinquain, or diamant could be used. Here is an example of a limerick.

THERE ONCE WAS A COMPUTER DISKETTE
A STATIC SHOCK IT HAD MET
TO BE SAFE AND SOUND
TOUCH METAL TO GROUND
AND LONG LASTING DISKETTES YOU WILL GET.

3. to demonstrate simple trouble-shooting techniques;
(Level 1-Introduction)
(Level 2-Expansion)
(Level 3-Proficiency)

Trouble-shooting techniques are the procedures to follow if trouble is encountered in the operation of the microcomputer system.

* At Level 1, show students how to check the power cord and ON/OFF switch(es).

* At Level 2, show students how to check for problems with visual display units such as monitors or televisions. Check that the visual display unit is turned ON, that it is turned to the correct channel (if appropriate), and that the contrast is adjusted properly.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

At Level 3, show students how to attach a peripheral device such as a graphics tablet, mouse, or printer to the microcomputer.

If all appears correct and the system still will not function, call a computer resource person.

4. to demonstrate the use of the microcomputer keyboard in immediate mode.
(Level 1-Introduction)
(Level 2-Expansion)
(Level 3-Expansion)

Computers operate in two different modes. These are immediate/direct mode and programming mode. Immediate/direct mode allows commands to be typed into the computer without the use of line numbers. Immediate mode is most often used for writing and calculations which do not require repetition.

All Commodore and TRS-80 Model I computers are in immediate mode when turned on. For Apple and TRS-80 Model III machines, follow the directions given below:

<u>Apple - Immediate Mode - Booting Instructions</u>

1. Ground yourself.
2. Turn on the monitor.
3. Turn on the microcomputer.
4. Press <CONTROL> <RESET> to stop the disk drive.
5. Type HOME and press <RETURN> to move the cursor to the top of the screen.
6. Type the message which you want to appear on the screen.
7. DO NOT press <RETURN>. Press <CONTROL> <X> to go to the next line or hold down the space bar until the cursor moves to the next line.
8. To erase the screen and return the cursor to the top of the screen type HOME and press <RETURN>.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Radio Shack (Model III) - Immediate Mode - Booting Instructions

1. Ground yourself.
2. Turn on the computer.
3. Wait for the red light to go off.
4. Hold down the BREAK key, press the orange reset button, let the rest button go, and let the BREAK key go.
5. When the screen says CASS?, press <ENTER> twice.
6. When the screen says READY
   > begin to type your message.
7. When you are finished typing DO NOT press <RETURN>. Hold down the space bar to move the cursor to the next line.
8. To erase the screen, press <CLEAR> and begin typing again.

Note: Students should be aware that use of <RETURN> in immediate mode will cause the appearance of the message "SYNTAX ERROR." This can be avoided by not pressing <RETURN> when using the microcomputer as a "visual typewriter." See manuals for your model/make of microcomputer for additional information.

* At Level 1, show students how to make print appear on the screen using the keyboard. Use the microcomputer as a "visual typewriter." — I-4-1 LA/TU

* At Level 2, show students how to use the microcomputer as a calculator in immediate mode. (Sometimes referred to as calculator mode.) On the computer, * is the symbol for multiplication and / is the symbol for division. The computer is pre-set to follow the established arithmetic order of operations. — I-4-2 H-o

* Level 3 students should review using the computer in immediate mode as a "visual typewriter" and as a calculator. Time permitting, students could be introduced to the use of variables in immediate mode. — I-4-3 Ma/H-o

UNIT II WHAT IS A COMPUTER?

This unit concentrates on the computer; what it is, and how it works. Computer components and processes will be introduced using a variety of concrete activities. Emphasis is to be placed on the input-processing-output sequence. Modern calculators, electronic games, and toys will be compared to and contrasted with the computer. Students are to explore the capabilities and limitations of the computer. Hands-on time with quality educational courseware which integrates with elementary curricula is a key component.

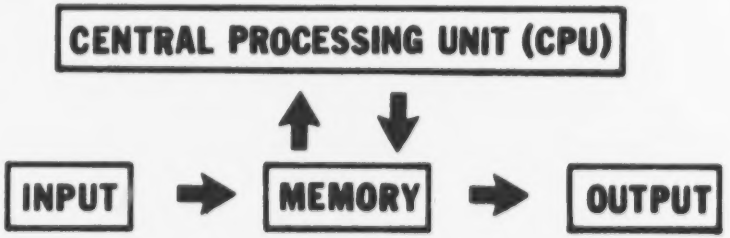
OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
The student should be able:		
1. to differentiate between hardware devices and software storage media; (Level 1-Introduction) (Level 2-Expansion)	The term "hardware" refers to the computer and all of its associated peripheral devices. The term "software" refers only to the programs which may be saved on software storage media such as cassette tapes, floppy disks, reel-to-reel tapes, keypunch cards, or punched tapes. Suggested activities: * Collect information and pictures of computer hardware from magazines, newspapers, and pamphlets. Make a collage of various computer components incorporating the names of each. * Technology is rapidly progressing. With this in mind, have students design a new piece of hardware for the year 2050. Write a description and draw a diagram of it. * Write an advertisement to sell a new piece of hardware to consumers. Sample steps in writing an advertisement include: 1. create a catchy title, 2. write a brief description of the item or article, and 3. describe briefly why someone should buy your item.	II-1-1 LA/Sc II-1-2 LA II-1-3 Ma II-1-4 Ma

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

2. to identify the major parts of a computer system and to explain the basic operation of each part in relation to the input-processing-output sequence;
(Level 2-Introduction)
(Level 3-Expansion)

The parts of a computer system include Input, Memory, Central Processing Unit (CPU), and Output as illustrated below.

II-2-1
LA



Input devices allow data to be entered into the computer. Examples of input devices include keyboard, graphics tablet, mouse, joystick, card reader, paper tape reader, light pen, disk drive, and cassette drive.

The memory stores programs, data, and information inside the computer. The CPU processes data according to instructions given.

The resulting processed data may be displayed or saved on one or more of the following output devices: printer ("hard" copy on paper), visual display unit (screen), audio unit (speaker), robotic device (turtle), disk drive, or cassette recorder.

Students should understand that the computer works as follows:

1. The computer receives information through an input device.
2. This information is sent to a memory location.
3. The information passes to the CPU where it is processed.
4. The results are sent to different memory locations.
5. These results are sent to an output device.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Note: It is suggested that the input-processing-output discussion begin with experiences familiar to students. For example, use the following activities:

* The teacher could sharpen a pencil and discuss the sequence of events in relation to input, processing, and output.

* Provide examples of input and processing. Have the students supply examples of output.

Examples:	Input	Processing	Output
	dirty teeth	brushing	_____
	Kool-Aid	freezing	_____
	paper	painting	_____

* Provide examples of input and output. Have the students supply examples of processing.

Example:	Input	Processing	Output
	dirty teeth	_____	clean teeth

* Provide examples of processing and output. Have the students supply examples of input.

Example:	Input	Processing	Output
	_____	brushing	clean teeth

II-2-2
LA

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Follow a three step procedure to relate human input/output, involving the five senses, to computer input/output.

1. Identify familiar sense modalities through which people receive input or exhibit output.

   * Have students identify the five modes. The teacher may choose to prepare a class demonstration or to arrange five stations at which the students could investigate the following materials. Using Activity II-2-3, students could record the observed human input and output. — II-2-3 Sc

   - . smell: common spices, fruit, etc.
   - . taste: pieces of fruit, cookies, vegetables, etc.
   - . feel: materials of varying texture, hardness, temperature, etc.
   - . hearing: cassette recordings of varying moods (e.g., humorous, sad, happy, frightening)
   - . sight: pictures, diagrams, or cartoons of varying moods (e.g., boring, humorous, complex, simple, sad, frightening)

2. Identify methods by which computers receive input or provide output. — II-2-4 LA/Sc

3. Compare and contrast input and output for people and for computers. To accomplish this, synthesize the information gained from Activities II-2-3 and II-2-4. Sample input/output for people and for computers follows:

72

73

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

PEOPLE	
INPUT	OUTPUT
see	
hear	
taste	
smell	
	sound (sing,cry)
	motor (write,run)

COMPUTERS	
INPUT	OUTPUT
	synthesized speech
	music
	robot movement
	printer
keyboard	
joystick	
mouse	
graphics tablet	
disk drive	disk drive
cassette recorder	cassette recorder
light pen	
	screen

3. to recognize that people control what computers do;
(Level 1-Introduction)
(Level 2-Expansion)
(Level 3-Expansion)

A computer gets instructions from a program written by a person. A program is a numbered, ordered series of instructions to the computer. Prepared software is comprised of programs that may be loaded into a computer.

Computers cannot "think" in the way people normally use the word. Thinking involves many processes which machines cannot perform. Computers cannot make value judgements or provide answers to every question.

II-3-1
LA

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Suggested Activity:

* Read a dictionary definition of "think." Discuss the definition and identify kinds of thinking. Take your list of kinds of thinking and determine if computers are capable of performing them.

4. to identify similarities and differences among computers, calculators, and electronic games; (Level 1-Introduction) (Level 2-Expansion)

Major similarities include: keyboard or buttons, visual display, and microchips. Major differences include: memory size (the amount of information that can be stored in the machine) and the number and variety of functions and capabilities available. Memory size is measured in "K" (approximately 1000 bytes or characters). This is approximately half of a double-spaced typewritten page.

Activity suggestions:

* Show pictures of various computers and discuss the kind of tasks they are capable of performing.

* Have students experiment with various tasks on the computer and the calculator. Discuss similarities and differences between the two machines.

* Display electronic games which students bring from home. Provide students with the opportunity to work with them. Discuss similarities and differences between these games and computers.

* Electronic games have become an important part of our everyday lives. Have students design a new electronic game and become a "super salesperson" to sell the new game to an arcade. The salesperson could provide the "buyer" with a pamphlet that describes how the game works, a picture of the game, and special features of the game.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
5. to recognize that computers are best suited to tasks requiring speed, accuracy, repeated operations, and the storage of large quantities of data; (Level 1-Introduction) (Level 2-Expansion)	The "Computer Trivia" - Activity II-5-1 - should be considered for class discussion at Level 1. At Level 2 teachers could design a research project for groups of students in which each group could investigate one of how computers are best suited to tasks requiring speed, accuracy, repeated operations or the storage of large quantities of information. Groups could present their findings to the class and publish the findings in a class book to be placed in the library. * Sample Activity Contest Set up a series of events in which students match speed with the computer. Note: Type NEW prior to entering/typing in each computer program which follows in the four components of the contest. i) Speed Print the numbers from 1 to 100. After the students have been given instructions and the computer has been programmed, say "go." Computer Program 5 HOME (Apple) 5 CLS (TRS) 5 PRINT " " (Commodore) 1Ø FOR X=Ø to 99 2Ø PRINT X + 1 3Ø NEXT X 4Ø END RUN	II-5-1 LA

NOTE: The "clear screen" command on Commodore machines is achieved by holding down the SHIFT key and pressing the CLR/HOME key.

ii) Accuracy

Write 375*96 on the chalkboard. Note that * is used for multiplication on a computer. After the question has been presented on the board, ask the students to solve the problem. Now input the problem into the computer and run it. Compare the accuracy of responses.

Computer Program

```
Print 375*96
```

iii) Repeated Operations

Ask students to write the line "I won't chew gum in school," 1ØØ times. Write a computer program to do the same task.

Computer Program

```
5 HOME (Apple) 5 CLS (TRS) 5 PRINT "♥"(Commodore)
1Ø FOR I = 1 to 1ØØ
2Ø PRINT    "I WON'T CHEW GUM IN SCHOOL"
25 PRINT
3Ø NEXT I
4Ø END
RUN
```

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

iv) Storing and Retrieving Large Amounts of Data

Write the following sequence of numbers on the chalkboard:

7 2 3 1 6 9 Ø 4 7 2 1 5 3 6

Ask students to memorize the number while the teacher types the following commands into the computer:

```
NEW
5 HOME (Apple) 5 CLS (TRS) 5 PRINT "■ (Commodore)
1Ø PRINT "7 2 3 1 6 9 Ø 4 7 2 1 5 3 6"
2Ø END
```

Erase the numbers from the chalkboard and clear the computer screen. Then have the students write the sequence in competition with the computer. (Teacher types RUN.)

6. to use prepared software programs in a microcomputer.
(Level 1-Introduction)
(Level 2-Expansion)
(Level 3-Expansion)

The teacher should provide as much "hands-on" computer experience as possible using educational courseware such as simulations, educational games, and other high quality courseware that supports discovery-learning and problem solving. The use of high quality educational courseware can be integrated with other elementary curricula and should be an ongoing part of the 4-6 Computer Awareness program.

The teacher could refer to the Resource Materials section of this guide to identify some appropriate courseware.

UNIT III: HOW COMPUTERS HAVE DEVELOPED

This unit is intended to expose students to the development of calculation aids from finger calculators to modern computers. Emphasis is placed on the increase in complexity and capacity of calculation aids but not on formal history. It is recommended that students be provided with "hands-on" experience using devices such as the abacus, slide rule, mechanical calculator, electronic calculator, and electronic learning aids as well as the microcomputer. After students have investigated past and present technological developments, they should spend time discussing and predicting future trends.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
The student should be able:		
1. to identify and to describe early computing devices which led to the development of the modern computer; (Level 3-Introduction)	Major stages in the development of the modern computer are listed below. Choose topics which best meet students' needs. The key concept is that devices progressively improve in speed and capability. Development proceeded as follows: . finger calculation . abacus - 2000 B.C. . Stonehenge - 1800 B.C. . William Oughtred develops the slide rule - 1621 A.D. . Napier's Bones - 1640 . first mechanical calculating machine, Blaise Pascal - 1642 . first use of punched cards, Joseph Jacquard - 1775 . Difference Engine (mechanically produced logarithmic tables) Charles Babbage - 1812 . Analytical Engine - all components of a modern computer including memory, control, arithmetic/logic unit, and input/output capabilities, Charles Babbage - 1833 . Ada Lovelace, recognized as the first computer programmer . first cash register, James Ritty - 1878 . first adding machine to record entries on paper with running totals, William S. Burroughs and Thomas Metcalfe - 1880	III-1-1 LA III-1-2 Ma

. Hollerith's sorter - improved on the punch card system, used electrical contacts to sense holes and provided the first mechanical method of sorting census data, Herman Hollerith - 1890
. COLOSSUS was developed during World War II by the military to decipher German code - 1943
. John Mauchly and John Presper Eckert built ENIAC using vacuum tubes - 1945
. the transistor was developed at Bell Laboratories - 1948
. integrated circuits - 1960's
. micro miniature circuits (microchips) - 1970's

Suggestions for activities:

* Establish a learning centre with samples of calculating devices such as the abacus, slide rule, mechanical calculator, electronic calculator and microcomputer.

* Design a timeline depicting the major advances in computer technology since 1940.

* Examine editions of old magazines, newspapers, catalogues or reference books to locate pictures, advertisements or articles relating to computers of the past.

* Good subjects for report writing or presentations are:

Napier	Babbage	Hollerith
Lovelace	Burroughs	transistor
Jacquard	ENIAC	integrated circuit
abacus	vacuum tube	Pascal

87

86

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
2. to recognize the four generations of computer development; (Level 3-Introduction)	Teachers should stress the concept of increasing capabilities over time. Students are not expected to memorize all the details which follow. First Generation of Computers (1950-1959) . vacuum tube design . large size . speeds measured in the millisecond range . generated enormous amounts of heat (required large air conditioning units) . consumed great quantities of electricity . unreliable . programmed in machine language Second Generation of Computers (1960-1965) . transistor design . physically smaller than predecessors . speeds measured in the microsecond range . magnetic core storage . larger storage capacity permitted more input and output devices . programmed in symbolic languages Third Generation of Computers (1965-1975) . solid state technology or integrated circuit design . speeds measured in the nanosecond range . cooler operating . main storage technology changed (magnetic core replaced by plated wire) ...	

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

. multi-programming (several programs executing simultaneously)
. accessing computer from remote locations made possible
. computer languages improved

Fourth Generation of Computers (1975-)

. microelectronic technology (the microchip)
. places into hardware (ROM) what was previously in program code (software)
. performance improved several orders of magnitude
. allows main storage to be expanded to millions of characters by utilizing direct access storage as an extension of main storage
. development of the microcomputer
. the virtual machine concept allows a single computer to function as several different computers simultaneously
. computers and software available at low cost
. Silicon Valley develops

Activity suggestions:

* Show generations of computers on a bulletin-board display.

* Collect examples of a vacuum tube, a transistor, an integrated circuit board and a microchip. Prepare a display according to the four generations of computer development.

3. to describe possible future technological developments based upon recent trends.
(Level 3-Introduction)

Activity suggestions:

* Prepare a cartoon showing technological advances. Students should be prepared to discuss their cartoons and to indicate whether they believe these changes are realistic during their lifetime.

III-3-1
LA/SS

90

91

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

* Write a brief autobiography of your life in the year 2020. Assume the same age as you are now.

* Compare a famous robot such as R2D2 in "Star Wars" with a real robot or computer.

* Future children may spend so much time with "thinking machines" (games, recreational reading, news, school, research, T.V., telephone calls, movies, and 3D-TV) that their bodies may suffer badly from a lack of exercise. The task is to create games and/or equipment and/or fun experiences which will encourage children and/or adults to exercise every day.

* Design and create a city of the future. Describe means of transportation, communication, education, entertainment, etc. in your city.

* Design a model computer. Describe how your computer works. Include input, processing, and output. Would you consider your computer to be real or fictional?

UNIT IV. HOW TO MAKE COMPUTERS WORK FOR YOU

This unit leads students from linear sequencing skills to procedural thinking. Students learn to control the computer using Logo. Development begins with pre-Logo activities involving concrete devices and leads to experimentation using the "screen turtle" in immediate mode. After appropriate hands-on experimentation, students begin to recognize the need to create, edit and save simple Logo procedures. As the need arises, students create procedures which may be used as subprocedures in top-down problem solving. The techniques of repetition and recursion are introduced to simplify/enhance Logo procedures.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

The student should be able:

1. to identify and to sequence the steps needed to accomplish a task;
   (Level 1-Introduction)
   (Level 2-Expansion)
   (Level 3-Expansion)

Sequencing step-by-step procedures involving logical and sequential thinking is fundamental to problem solving. This sequencing could be dealt with either informally or formally.

Informal sequencing is similar to sequencing presently done in Language Arts. Simple problem solving such as writing directions or sequencing daily events could be encouraged and practiced informally by first ordering specific steps in a procedure and then testing the procedure to find possible errors.

More formal sequencing could involve simple flowcharting which can be used to visually organize the steps in a procedure.

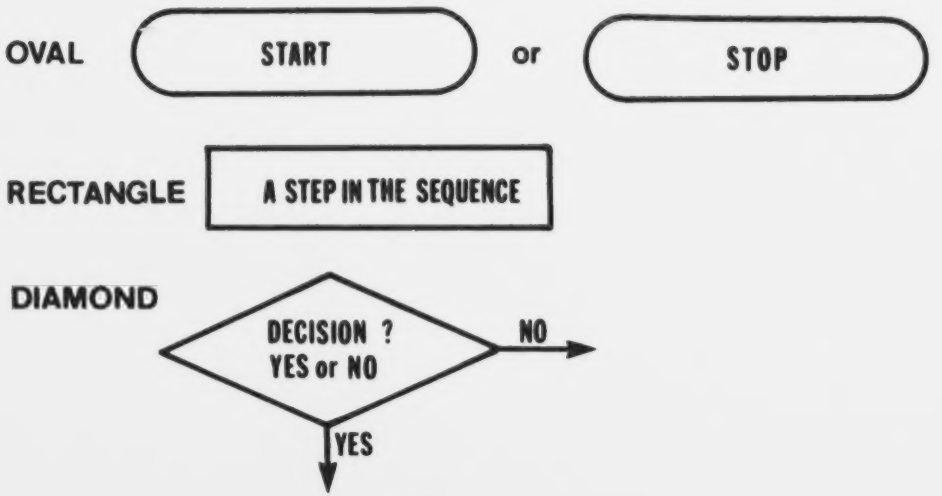
Examples of procedures to sequence include:

- baking a cake
- making a triple-decker ice-cream cone
- going to school
- counting from one to a hundred
- sharpening a pencil

. greeting your uncle with a kiss and your aunt with a handshake
. cleaning your room
. mowing the lawn
. setting the table
. scaring your mom with a . . .
. making a hand puppet
. climbing a tree
. making toast
. building a chair
. getting from your home to school
. buying a pair of jeans
. playing a game

Any procedure involving a series of steps could be used to demonstrate sequencing.

In order to draw a flowchart, the teacher should introduce the following symbols:



OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

NOTE:
- Begin and end a flowchart with an oval.
- The direction of flow usually is from top to bottom.
- Flowlines should never cross.
- Use a ruler to draw flowlines.
- In the decision diamond, only ask questions which can be answered with "YES" or "NO".

Notice that the decision "YES" directs the flow down to the next step in the sequence but the "NO" decision directs the flow to the right and either loops back repeating part of the sequence or jumps forward, skipping part of the sequence.

At Level 1, students should sequence steps in simple procedures which do not involve decisions. — IV-1-1 LA

At Level 2, students should be introduced to the decision diamond. Sequencing should involve one decision which loops back repeating part of the sequence. — IV-1-2 LA

At Level 3, students should sequence more complex procedures involving more than one decision. — IV-1-3 LA

For enrichment, the teacher may wish to introduce procedures involving decisions which jump forward, skipping part of the sequence.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

2. to understand that a computer language must be used to communicate with a computer;
(Level 1-Introduction)
(Level 2-Expansion)
(Level 3-Expansion)

Just as people need to communicate using a language which follows certain grammatical rules (syntax), they need to use a computer language and its correct syntax to communicate with a computer.

Several computer languages in common use include:

- Logo - a graphics-based procedural language which is suitable for introduction at the elementary level.
- BASIC - an acronym for Beginners All-purpose Symbolic Instruction Code, a common microcomputer language which uses common English key words.
- FORTRAN (Formula Translator) - a language developed especially for scientific and mathematical problems.
- COBOL (COmmon Business Oriented Language) - a language developed for business use.
- Pascal - a language developed for mathematical applications.

Activity suggestions:

* Ask students to brainstorm for the names of various human languages (English, French, German, Ukrainian, etc.). Then, extend this activity to have students identify names of computer languages.

* Using a suitable software package, prepare a crossword puzzle or word find using the names of human and computer languages.

Logo

Logo is recommended for 4-6 Computer Awareness as it offers the unique opportunity for students to have control over their computer environment. In doing so, Logo provides an excellent beginning computer experience for young students. Developing a rich culture of Logo experiences at an early stage in computer awareness will allow students to continue using Logo successfully and productively through secondary school and perhaps even at the college level. Seymour Papert, the creator of Logo, describes the "turtle" as a kind of "object to think with".

The "turtle" is a graphic character which is controlled through a Logo or Logo-like computer language.

The Logo language is commercially available on diskette for specific microcomputers. Logo-like languages are also available. In order to complete Unit IV, a Logo or Logo-like language is required. The following list of Logo and Logo-like languages may help the teacher identify and acquire a suitable version for use in the classroom.

A. APPLE MICROCOMPUTERS

1. Apple II+ and/or Apple IIe
   - i) Apple Logo- commercially available
   - ii) Krell Logo - commercially available
   - iii) Sprite Logo - commercially available
   - iv) Terrapin Logo - commercially available
   - v) Apple Turtles - Logo-like language available from the Educational Technology Program

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

B. COMMODORE MICROCOMPUTERS

1. Commodore 64
   i) Commodore 64 Logo (version of Terrapin) - commercially available
   ii) C64 Turtles - Logo-like language available from the Educational Technology Program

2. Commodore PET (4032, 8032, Super PET)
   i) Kidstuff - Logo-like language available commercially
   ii) PET Turtles - Logo-like language available from the Educational Technology Program

C. RADIO SHACK MICROCOMPUTERS

1. Radio Shack Color
   i) Color Logo - commercially available

2. TRS-80 Model III or IV
   i) TuRtleS - Logo-like language available from the Educational Technology Program

Recommended print materials include:

1. Watt, Daniel. Learning With Logo.
2. Papert, Seymour. Mindstorms.
3. Moscovitch Webb, Joan, P. von Mertens, and M. N. Holmes. Explorer's Guide to Apple Logo. (Apple)
4. Educational Technology Program. Taming TuRtleS. (Radio Shack)
5. Educational Technology Program. Training Your PET Turtles. (Commodore)

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OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

3. to relate the Logo turtle's language to human movement;
(Level 1-Introduction)
(Level 2-Expansion)

The language of the turtle is very simple to understand. The primitives or words that form the language are descriptive of the turtle's movements. These primitives also can be used to describe human movement. The teacher should have students model the movements of the turtle by reacting to the primitives as the turtle would. Some suggestions for "human turtle" activities are:

* The teacher, acting as the "human turtle," should introduce the four Logo primitives FORWARD, BACK, LEFT, and RIGHT. The teacher then asks students to suggest commands which would successfully move the "human turtle" from one point in the classroom to another point.

* Students could take turns being the "human turtle" while classmates give commands to direct their movement.

* A masking tape maze could be created on the floor of the classroom. The students could be actively involved in creating the maze. The "human turtle" then is directed through the maze using the Logo commands given by the students. The Logo commands given to the "human turtle" should be recorded and used as a basis for further discussion.

* The following "human turtle" activity is based on orienteering. A map of the school ground is needed or could be developed. Students could estimate the number of steps required to walk the length of the wall of the school. Have students plan a series of Logo commands which would take them all the way around the perimeter of the school or building. Once students have pre-planned their Logo commands on paper they can test them out physically with the help of a partner.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
4. to relate the Logo turtle's language to manipulation of a "concrete turtle"; (Level 1-Introduction) (Level 2-Expansion)	To ease the transition from "human turtle" to "screen turtle", Level 1 students could manipulate a "concrete turtle" using the same Logo primitives. The size of the "concrete turtle" steps must be defined in relation to the type of "concrete turtle" used. Suggested activities: * Have the students make one of the following "concrete turtles": a) paper maché turtle b) stuffed paper turtle c) stuffed fabric turtle * Use the tiles on the floor in the classroom to design a maze through which the "concrete turtle" moves. * The teacher can make a "chalk turtle" by attaching a small outline of a turtle to the end of a piece of chalk. As the teacher moves the "chalk turtle" on the board, the students can move their "concrete turtles" in the same way. At Level 2, the Logo primitives should be reviewed. The primitives could be practiced in class as they were in Level 1. Students should proceed from the concrete to the abstract, walking through the commands using the "human turtle" and progressing through concrete models of the turtle before using the "screen turtle".	IV-4-1 Art/Lo/TU IV-4-2 Art/Lo/TU
5. to relate the Logo turtle's language to the manipulation of a robotic device; (Level 3-Introduction)	In Levels 1 and 2, students have acted as "human turtles" and have manipulated a "concrete turtle" in preparation for manipulating the "screen turtle." Now at Level 3, students may be challenged to use their knowledge of Logo to manipulate a robotic device in more sophisticated ways.	

Robotic devices such as the Big Trak Robot, Tasman Turtle, and TurtleTot give students a unique opportunity to manipulate the Logo environment in a direct way. Using the appropriate Logo software, students are able to use the robot turtle as "an object to think with".

Big Trak Robot:

Using Big Trak students should be encouraged to explore the range of its movements. Teachers should refer to the Operator's Manual that comes with Big Trak. Teachers may wish to make a cloth or paper cover for Big Trak to make it appear more turtle-like.

Robot Turtle (TurtleTot or Tasman Turtle):

The teacher will need a version of Logo such as Apple Logo, Terrapin Logo, MIT Logo, Krell Logo, Apple Turtles or others which support the robot turtle.

* After the students have had experience exploring with Big Trak or the robot turtle, the teacher may wish to have the students construct a "turtle community". Using their knowledge of Logo, the students could then move the robotic device through this "turtle community".

* Students may construct an obstacle course, using objects found in the classroom, for the robotic device to go around, under and through.

* Students may develop a procedure or modify a procedure from a previous level, for use with the robot turtle.

* Students may design a robot turtle procedure to create a poster or sign for the robot turtle to draw. This drawing may be used as part of a class display.

Distributors of Robotic Devices:

BIG TRAK

K-12 Micro Media
172 Broadway
Department CL
Woodcliffe Lake, NJ 07675
U.S.A.

Approximately $60.00 American

TASMAN TURTLE

Harvard Associates Inc.
260 Beacon Street
Somerville, MA 02143
U.S.A.

Approximately $1000.00 American

TURTLETOT

Harvard Asociates Inc.
260 Beacon Street
Somerville, MA 02143
U.S.A.

Approximately $400.00 American

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
6. to devise, record, test, and revise a plan for the creation of a design using the Logo "screen turtle in immediate mode; (Level 1-Introduction) (Level 2-Expansion) (Level 3-Expansion)	After students have played the role of "human turtle" and have manipulated a "concrete turtle" or "robot turtle," they should be ready to make the transition to the "screen turtle." One way to introduce students to the "screen turtle" is to conduct a class demonstration. One computer and a monitor positioned so that all students may see the screen, are needed. The teacher could direct a class discussion and investigation of how the "screen turtle" moves in immediate mode. At this time, depending on student need, the teacher may wish to introduce the concept of repetition as outlined in Objective IV-8. The teacher may wish to have students begin their Logo exploration on the computer working in pairs. Working together encourages sharing of ideas, fosters cooperative behaviour, and is more time efficient.	IV-6-1 Lo
	Suggested activities:	IV-6-2 Lo/TU
	* Students could compare the size of 10 "screen turtle" steps to that of 10 "human turtle," "concrete turtle" or "robot turtle" steps.	IV-6-3 Lo/H-o
	* Students could estimate the number of steps the turtle must take to move from the centre of the screen to a specified boundary near the edge of the screen.	IV-6-4 SS/Lo/H-o
	* If students have not yet been introduced to angular movement in degrees then the teacher may wish to introduce degree measure as part of the demonstration. Use the Turtle Turning Wheel, found in Activity IV-6-1, to assist students in their exploration of angular movement.	IV-6-5 Lo/H-o
	As students begin their experience with Logo in the classroom, they should be encouraged to keep a record of their activities and procedures in their own Logo Log Book. A Logo Log Book cover and	IV-6-6 Lo/H-o

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	Tables of Procedures is found in Activity IV-6-7. The Logo Log Book is designed to hold completed activity sheets as well as any procedures the students may have completed independently.	IV-6-7 Lo/H-o
	Students should give a name or a title to each procedure they create. These names can be used later when saving procedures on diskette. Students can use any previously created procedures. The techniques of using procedural building blocks to construct more complex procedures, is of major importance for top-down problem solving in the Logo language.	IV-6-8 Lo/TU IV-6-9 Lo/H-o/TU
7. to create, edit and save procedures, subprocedures, and superprocedures using Logo or a Logo-like language; (Level 1-Introduction) (Level 2-Expansion) (Level 3-Expansion)	A procedure is a sequence of Logo primitives created to complete a specific task. Every procedure should have a unique name. Procedures can be saved on diskette for future use and can be modified (edited) to accomplish a different task. A superprocedure is a complex procedure composed of a number of simple subprocedures. Each version of a Logo or Logo-like language has a unique system for creating, saving, and editing procedures. Teachers should consult the user's manual for their version of Logo to determine the appropriate commands to use.	
	Level 1	
	At Level 1, students should begin by creating a simple procedure. Before students go to the computer, they should plan their procedure in their Logo Log Book. The plan should include a diagram. Using the diagram, students should manipulate a concrete device such as the "Pencil Turtle". This "Pencil Turtle" will help the students visualize their procedure in terms of a sequence of primitives. Students should give the procedure a unique name.	IV-7-1 Lo

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Teachers should refer to the Notes and Explanations found in Objective IV-4 for information concerning other "concrete turtles".

Suggested activity:

* As a small group activity the teacher could challenge the group to solve a specific Logo task. One student then sketches the diagram of a solution on the chalkboard. With another student acting as the recorder of the Logo primitives, the group directs the "chalk turtle" step-by-step to redraw the sketch.

When students are ready to begin entering their procedure into the computer, the teacher could conduct a class demonstration showing the methods for creating, saving on diskette, and editing a simple procedure for their particular version of Logo. Students will need these skills to save and edit their own procedures.

The teacher may wish to use the following example in the demonstration:

1. Before beginning the demonstration, take the turtle HOME and then clear the screen.

2. Show the students how to define the following procedure named HOUSE by entering it into the computer.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

```
TO HOUSE
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 150
FORWARD 150
LEFT  120
FORWARD 50
END
```

NOTE: This procedure is written with two bugs which create an "envelope" instead of a house. Later in the demonstration these bugs will be corrected by editing the procedure HOUSE.

3. Take the turtle HOME and clear the screen.

4. Have the turtle execute the procedure named HOUSE by typing HOUSE. Students will see an unexpected result.

5. The students should record the procedure and draw the diagram in their Logo Log Book.

6. Show the students how to save the procedure HOUSE onto diskette.

7. Show the students that saving a procedure on a diskette creates a permanent record. Remove the diskette and turn off the computer. Reload Logo, examine the catalog of procedures saved on the diskette and point out the procedure HOUSE. Load HOUSE and have the turtle execute HOUSE.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

8. Have the students identify the bugs and suggest the changes needed to create a proper house. Using the EDIT mode, show the students how to make the changes to the procedure HOUSE. One possible solution is shown below:

```
TO HOUSE
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 90
FORWARD 50
RIGHT 150 change to RIGHT 30
FORWARD 50
LEFT 120 change to RIGHT 120
FORWARD 50
END
```

9. Have the students note the changes in their Logo Log Book.

10. Review with the students how to save the new version of HOUSE, noting that it replaces the old version of HOUSE.

IV-7-2
Lo/H-o

IV-7-3
Lo/H-o

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Level 2

At Level 2, teachers should review with the students how to create, save, and edit a procedure. In addition, students could be shown how to load an existing procedure, edit that procedure to create a new one, rename the procedure, and save the procedure under the new name. The teacher may wish to use the following example in a class demonstration:

1. Before beginning the demonstration, take the turtle HOME and then clear the screen.

2. As a class, ask the students to create a procedure named SMALLTRI which will draw a small triangle. Enter it into the computer and save it on diskette.

3. Remove the diskette and turn off the computer. Reload Logo and the procedure named SMALLTRI.

4. With assistance from the class, edit the procedure named SMALLTRI to create a new procedure which will draw a bigger triangle.

5. Edit the former name SMALLTRI to become BIGTRI.

6. Save this procedure under its new name BIGTRI. — IV-7-4 SS/Lo/H-o

7. Catalogue the diskette to see that both SMALLTRI and BIGTRI exist as procedures on that diskette. — IV-7-5 Lo/H-o

NOTE: The teacher should emphasize that this technique can be used as a method for creating new procedures, which are similar to old procedures, without destroying the old procedure.

Once a procedure has been created and saved, it becomes a primitive in the turtle's "vocabulary". Students now may use this new Logo primitive as a building block or subprocedure in a more complex superprocedure.

The teacher may wish to conduct a class demonstration which combines two subprocedures (TRIANGLE and BOX) into a superprocedure (HOUSE).

```
TO BOX
FORWARD 30
RIGHT 90
FORWARD 30
RIGHT 90
FORWARD 30
RIGHT 90
FORWARD 30
RIGHT 90
END
```

```
TO TRIANGLE
FORWARD 30
RIGHT 120
FORWARD 30
RIGHT 120
FORWARD 30
RIGHT 120
END
```

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

```
TO HOUSE
BOX
TRIANGLE
END
```

NOTE: The HOUSE procedure has a bug. Students should create a MOVE procedure which will orient the turtle so that the triangle is drawn on top of the box.

A possible solution follows:

```
TO MOVE
FORWARD 30
RIGHT 30
END

TO HOUSE
BOX
MOVE
TRIANGLE
END
```

Suggested activity:

* Students should plan a superprocedure which contains as subprocedures, any procedure(s) previously created (such as SMALLTRI, BOX, or any other procedures from their Logo Log Book). Once the plan is complete, students should enter their superprocedure into the computer, do any necessary editing, and save the superprocedure. If possible, print out the final design and a listing of the steps in the superprocedure. These printouts could be posted in a display or placed in the student's Logo Log Book.

Level 3

By Level 3, students have had experience using subprocedures to create superprocedures. Now at Level 3, the teacher should place the emphasis on creating superprocedures by using the top-down approach to problem solving.

TOP-DOWN PROBLEM SOLVING

Top-down problem solving starts from the "top" or general ideas, and systematically works "down" to the details.

Top-down problem solving can be broken down into the following five steps:

1. Sketch a diagram of the design which will be created by the superprocedure. Give the superprocedure the same name as the design.

2. Label the component parts of the diagram. In the creation of the superprocedure, the names of the component parts will be used as the names of the subprocedures.

3. Write and test the superprocedure.

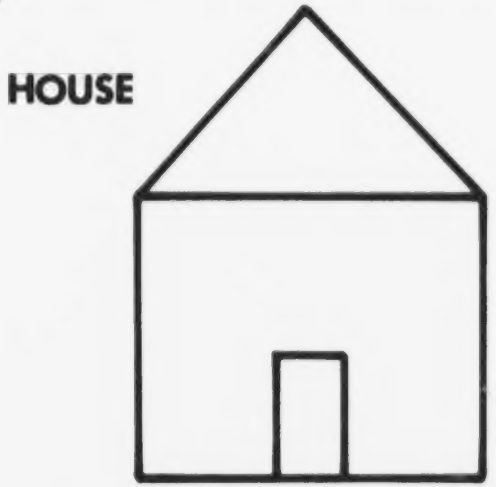
4. Write the subprocedure called for by the superprocedure.

5. Test the superprocedure and repeat steps 4 and 5 until the superprocedure produces the desired design.

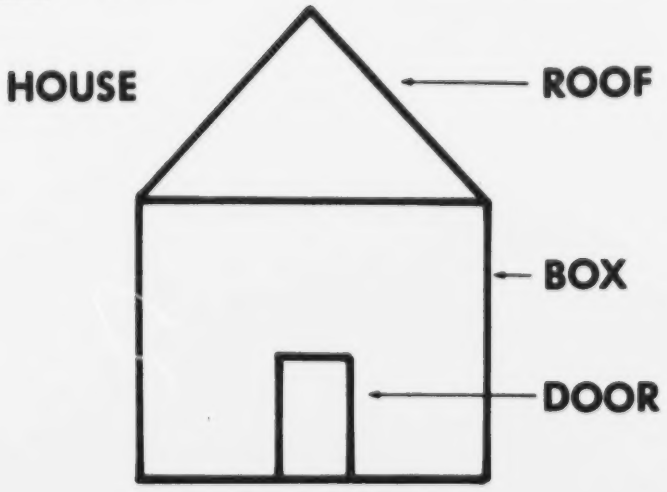
OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

The following explanation is an illustration of the five steps involved in problem solving. The teacher may wish to use it in a class demonstration.

Step 1. Sketch.



Step 2. Label.



OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Step 3. Superprocedure.

```
TO HOUSE
BOX
MOVE1
ROOF
MOVE2
DOOR
END
```

NOTE: Enter this superprocedure into the computer. Test the superprocedure by typing HOUSE. The computer should respond "I DONT KNOW HOW TO BOX".

Step 4. Subprocedure.

```
TO BOX
FORWARD 30
RIGHT 90
FORWARD 30
RIGHT 90
FORWARD 30
RIGHT 90
FORWARD 30
RIGHT 90
END
```

NOTE: Enter this subprocedure into the computer.

Step 5. Test the superprocedure HOUSE.

NOTE: The teacher will find that the turtle will draw the box and then respond "I DONT KNOW HOW TO MOVE1".

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Repeat Step 4 by writing the subprocedure MOVE1 and entering it into the computer.

```
TO MOVE1
FORWARD 30
RIGHT 30
END
```

Repeat Step 5 by testing the superprocedure HOUSE. The teacher will find that the turtle will draw the box, move to the position where the roof will start, and respond "I DONT KNOW HOW TO ROOF".

Repeat Step 4 by writing the subprocedure ROOF and entering it into the computer.

```
TO ROOF
FORWARD 30
RIGHT 120
FORWARD 30
RIGHT 120
FORWARD 30
RIGHT 120
END
```

Repeat Step 5 by testing the superprocedure HOUSE. The turtle will draw the box, move to the position where the roof will start, draw the roof and respond "I DONT KNOW HOW TO MOVE2".

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Repeat Step 4 by writing the subprocedure MOVE2 and entering it into the computer.

```
TO MOVE2
RIGHT 150
FORWARD 30
LEFT 90
FORWARD 10
LEFT 90
END
```

Repeat Step 5 by testing the superprocedure HOUSE. The turtle will draw the box, move to the position to draw the roof, draw the roof, move to the position to draw the door, and respond "I DONT KNOW HOW TO DOOR".

Repeat Step 4 by writing the subprocedure DOOR and entering it into the computer.

```
TO DOOR
FORWARD 15
RIGHT 90
FORWARD 10
RIGHT 90
FORWARD 15
RIGHT 90
FORWARD 10
RIGHT 90
END
```

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Repeat Step 5 by testing the superproceadure HOUSE. The turtle will draw the desired design, HOUSE.

Using the previous example, the teacher should emphasize that top-down problem solving begins with the general idea, HOUSE, and proceeds to the details of the subprocedures as they are needed.

Suggested activities:

* With students working in pairs, challenge them to use the top-down problem solving approach to create a "stick" figure. Students should use their Logo Log Book to sketch the "stick" figure, label its parts, and list the superprocedure before proceeding to the computer to solve each subprocedure.

* The teacher may wish to involve the entire class in a top-down problem solving project. Such a project could be related to a theme being studied in another curriculum area. The steps of sketching the design, labelling the diagram, and writing the superprocedure on the computer could be done by the entire class. Then, the class should be divided into the same number of groups as subprocedures. Each group then works independently to write the assigned subprocedure. Once each subprocedure is complete, the entire class should then test the superprocedure using the top-down approach. As the testing progresses, each group enters their subprocedure when called for by the superprocedure.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

8. to use repetition to simplify and to enhance Logo procedures;
(Level 1-Introduction)
(Level 2-Expansion)
(Level 3-Expansion)

Repetition can be used to simplify procedures which consist of a pattern of repeating steps. Conversely, repetition can be used to enhance simple procedures by placing them within the REPEAT creating more intricate designs.

Depending on the needs of the students, teachers may wish to introduce repetition in Unit IV, Objectives 6 and 7.

Many logo procedures create shapes which consist of a repeated sequence of commands. For example, students may have created a square shape by using commands similar to these:

```
FORWARD 40
LEFT 90
FORWARD 40
LEFT 90
FORWARD 40
LEFT 90
FORWARD 40
LEFT 90
```

Students may notice that the pattern

```
FORWARD 40
LEFT 90
```

must be repeated four times in order to complete the shape.

Students can simplify the task of drawing the box by using the REPEAT command as follows:

```
REPEAT [FORWARD 40 LEFT 90]
```

The REPEAT primitive or command allows the turtle to repeat a list of commands, or a procedure, a specified number of times. The REPEAT command has two inputs:

. number of times to repeat
. [what is to be repeated]

Note: The sequence of commands to be repeated must be enclosed within square brackets.

The REPEAT command can be used in a number of ways:

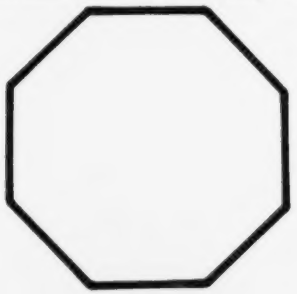
1. in immediate mode
2. within a procedure
3. to contain a procedure

1. The REPEAT command may be used in immediate mode. For example: IV-8-1 Lo/H-o

```
REPEAT 8 [FORWARD 40 RIGHT 45]
```

instructs the turtle to repeat 4 times, the commands found within the square brackets.

The turtle draws the following shape:



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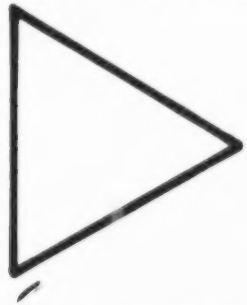
2. The REPEAT command may be used within a procedure. For example:

```
TO TRIANGLE
REPEAT 3 [FORWARD 50 RIGHT 120]
END
```

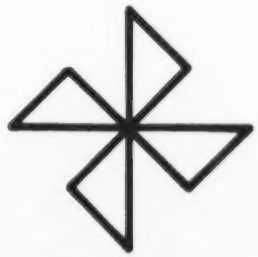
The turtle draws the following shape when TRIANGLE is typed.



3. A procedure may be used within a REPEAT command. For example, using the procedure TRIANGLE from example 2:

```
TO WINDMILL
REPEAT 4 [TRIANGLE RIGHT 90]
END
```

The turtle draws the following shape when WINDMILL is typed.



OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

Suggested activities:

* Students could use the REPEAT command in immediate mode, or in the definition of procedures, to draw regular polygon shapes such as the triangle, square, pentagon, hexagon or octagon.

* Students could enhance a simple procedure from their Logo Log Book by placing it within a REPEAT command.

9. to create recursive Logo procedures.
(Level 2-Introduction)
(Level 3-Expansion)

Recursion is a more powerful form of repetition than REPEAT. A Logo procedure is recursive when it creates a copy of itself. There are two forms of recursion.

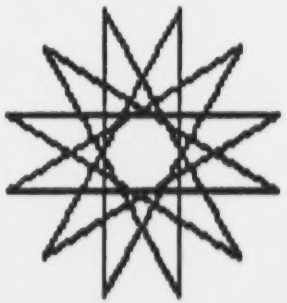
. Tail-end recursion
. Embedded recursion

The Logo activities in this 4-6 Computer Awareness Interim Guide introduce and expand only on tail-end recursion. Embedded recursion will be covered in future computer studies.

A recursive procedure of the tail-end form always contains the name of that procedure as its last command.

For example:

```
TO SHAPE
FORWARD 30
RIGHT 150
FORWARD 60
SHAPE
END
```



OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

NOTE: This recursive procedure is unending and must be stopped manually by pressing the appropriate stop key.

At Level 2, the activities will be hands-off and will not require a computer. IV-9-1 Lo/TU

The purpose of these activities is to provide Level 2 students with recursive experiences of a concrete nature in preparation for hands-on work with recursion in Level 3. IV-9-2 Lo/TU

Suggested activity:

* Songs such as "Fréré Jacques" and "Row, Row, Row Your Boat", which are sung in the form of a round, are musical examples of recursion. Round-singing is recursive because the singing of the first part by one group, is a signal for the singing of the first part by another group, which is . . . The teacher could conduct a class activity in which the students sing in rounds. Students then discuss ways in which this activity illustrates recursion.

At Level 3, students write Logo procedures which contain tail-end recursion and enter these into the computer.

The teacher could show the following example of tail-end recursion in a class demonstration.

1. The teacher should type the following five procedures into the computer and save them on diskette prior to the demonstration.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

```
TO FOREST
TREE
MOVE
FOREST
END
```

NOTE: This is the procedure which contains recursion because the name of the procedure is contained within itself.

```
TO TREE
TRIANGLE
TRUNK
END
```

NOTE: This is a superprocedure which contains two subprocedures.

```
TO TRIANGLE
RIGHT 30
REPEAT 3[FORWARD 20 RIGHT 120]
END
```

```
TO TRUNK
RIGHT 60
FORWARD 10
RIGHT 90
FORWARD 10
END
```

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```
TO MOVE
PENUP
LEFT 45
FORWARD 20
PENDOWN
END
```

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES

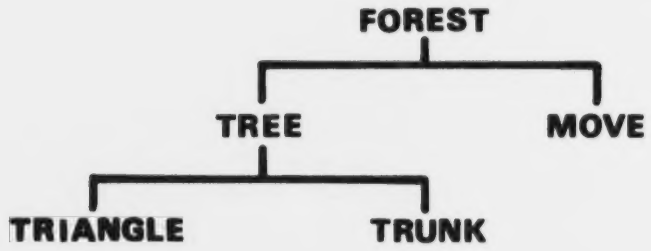
2. During the demonstration, the teacher could call up the saved procedures and move the turtle up near the top left hand corner of the screen before demonstrating the FOREST procedure.

3. The students could draw a sketch of the screen and list the FOREST procedure in their Logo Log Books.

4. The students could examine the FOREST procedure and suggest how recursion causes repetition of the trees across the diagonal of the screen.

NOTE: The following activity is suggested as a review of Objective IV-7 and to help students understand the demonstration.

* The students could be encouraged to examine the subprocedures contained within the FOREST procedure, to list them in their Logo Log Books, and to construct a diagram illustrating their interrelationship.



This diagram shows that FOREST is a superprocedure containing the TREE and MOVE subprocedures. TREE is itself a superprocedure containing the subprocedures TRIANGLE and TRUNK.

Suggested activity:

* The students could create a simple procedure or take one from their Logo Log Books and make it into a procedure which uses tail-end recursion. This is done by editing the original procedure so that the last command is the name of the procedure. For example:

Original Procedure	Recursive Procedure
TO INITIAL	TO INITIAL
FORWARD 40	FORWARD 40
LEFT 90	LEFT 90
FORWARD 15	FORWARD 15
BACK 30	BACK 30
END	INITIAL
	END

UNIT V. COMPUTERS IN OUR LIVES

Modern technology is affecting all aspects of our lives. This topic is intended to have students investigate the home, school, and community environment with respect to microchip technology. Similarities and differences between real and fictional computers are addressed.

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
The student should be able:		
1. to recognize the use of microchip technology: (Level 1-Introduction) (Level 2-Expansion)	Integrated circuits or microchips are the primary components of the new technology and are encountered in many facets of daily life.	
	Any classroom activity which promotes a greater awareness of the place of microchips in our lives should be encouraged. Brainstorming activities, class discussions, field trips, guest speakers, art collages, and posters are only a few ways a teacher could foster such awareness. An opinionnaire (V-1-1) could provide information on changes in student knowledge/attitudes if it is administered both at the beginning and at the end of the unit.	V-1-1 SS/TU
	Activity V-1-2 is a play in which students share information about how microchip technology is used in the home, school, and community. Students could use Activity V-1-2 or they could develop their own play relating to microchip technology in their environment.	V-1-2 LA/SS V-1-3 LA/TU

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
a) in the home,	Microchips are found in common home appliances such as microwave ovens, televisions, stereo equipment, clock radios, and video-recorders. Also, microchips are found in automobiles. Suggested activities: * Have students list five tasks done in the home by a machine which previously were done by a person. Pick one of these tasks and compare the old way and new way using at least five criteria such as manpower required, cost, resources needed, source of power/energy and the time needed to complete the task. * Have students list five jobs still done by people around the house. Students could select one of these jobs, imagine a machine which could do this job, draw and describe this machine, make-up a TV commercial for their machine, and present the commercial to the class.	V-1-4 LA/Ma/Sc/SS
b) in the community,	Computer generated materials such as telephone or hydro bills, form letters, or bank statements can be found in the daily mail. Many services such as banking, public utilities, newspaper publishing, health care, law enforcement, libraries, radio and television broadcasting, as well as education use computers in their operation. Businesses involved in manufacturing or retailing such as grocery stores, farm equipment dealers, textile manufacturers, and department stores could be explored to see how computer technology is used. Such exploration could involve guest speakers, tours or research projects.	

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
	Activity suggestions:	
	* Investigate the way in which computers are currently being used by Manitobans in the following areas:	V-1-5 LA/Ma/Sc/SS
	. medicine and health care . education and training . business and banking . transportation and traffic control . government . library . publishing/printing . farming . fire fighting . law enforcement . engineering and design . offices . defence systems . retail stores . manufacturing . public utilities . garment industry . hotels/motels . restaurants	
	* Propose the following situation. You are a computer salesperson. You have discovered a business or occupation not presently using computers. Compose a letter trying to convince them that a computer would be of benefit.	
	* Examine the careers section of a newspaper. Use a symbol to indicate which career advertisements require computer experience. Use a different symbol to indicate those which do not. Prepare a graph comparing those careers which require computer experience with those which do not.	
c) in recreation;	Students should be aware that video games, time clocks, scoreboards, electronic games, and sound synthesizers all use microchip technology.	V-1-6 LA

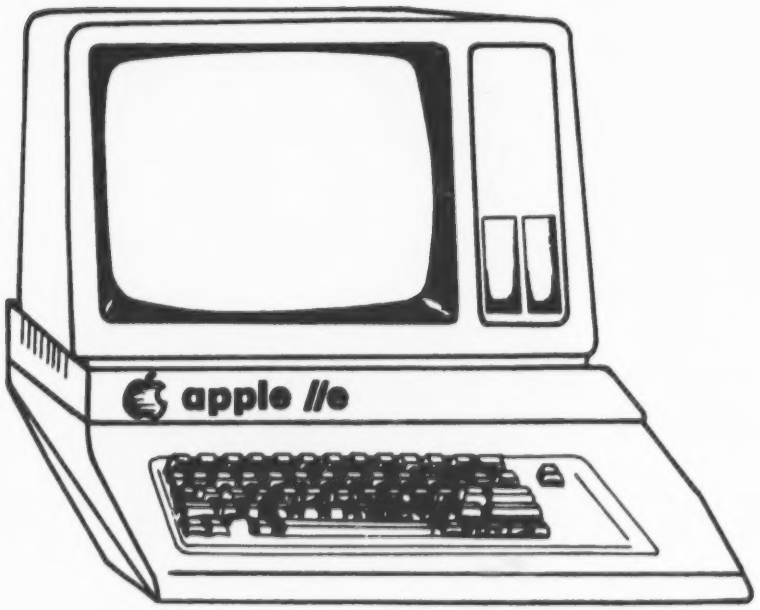
OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
2. to identify capabilities and limitations of the computer; (Level 3-Introduction)	Before initiating a discussion on computer capabilities and limitations, students should identify what people can and cannot do. Refer to Activity V-2-1 Computers are used in all areas of society in occuptions and services involving manipulation of information. Following is a list of some of the capabilities of the computer which have mad it so useful: . able to store and retrieve large amounts of information . able to access information rapidly . cost effective . accurate and very fast . able to perform repetitive tasks for long periods of time without error Students should be encouraged to identify limitations of computers as well as computer capabilities. The following is a list of some of the current limitations of computers: . cannot make value judgements (Is it better to be healthy rather than wealthy?) . cannot answer questions involving personal preferences (What colour of bicycle should I buy?) . cannot perform certain complex tasks either efficiently or effectively (medical procedures, parenting)	V-2-1 LA V-2-2 LA

OBJECTIVES	NOTES AND EXPLANATIONS	ACTIVITIES
3. to describe similarities and differences between computers in fiction and computers in reality. (Level 2-Introduction) (Level 3-Expansion)	As has been noted, in reality there are limits to computer capabilities. In fictional stories, however, there are no limits. Similarities and differences exist between real computers and computers in fiction. Suggested activities:	
	* Students could list fictional computers. Sources to consider include books, magazines, and movies.	V-3-1 LA
	* Students could compare fictional and real computers as to their similarities and differences.	V-3-2 LA
	* Students could invent what they consider to be the perfect fictional computer. They could write about this computer, draw it, as well as construct a model of it.	V-3-3 LA

activities

COMPUTER REMINDERS

I-1-1
Level 1
LA/TU
P.1 of 3



91

STEPS FOR "BOOTING" AN APPLE MICROCOMPUTER

1. Ground yourself.
2. Turn on the monitor.
3. Insert the diskette face up into the slot in drive 1.
4. Close the door of the disk drive.
5. Turn on the power switch at the back of the microcomputer.
6. Wait until the red light on the front of the disk drive goes off for the first time.
7. Make your program selection from the menu on the screen.

The following steps are necessary only if the software is NOT menu-driven.

8. Type the word CATALOG. Press <RETURN>.
9. The catalog or menu will appear on the screen.
10. Type LOAD and the name of the program you wish to run. Press <RETURN>.
11. Type RUN. Press <RETURN>.

COMPUTER REMINDERS

I-1-1
Level 1
LA/TU
P.2 of 3

92

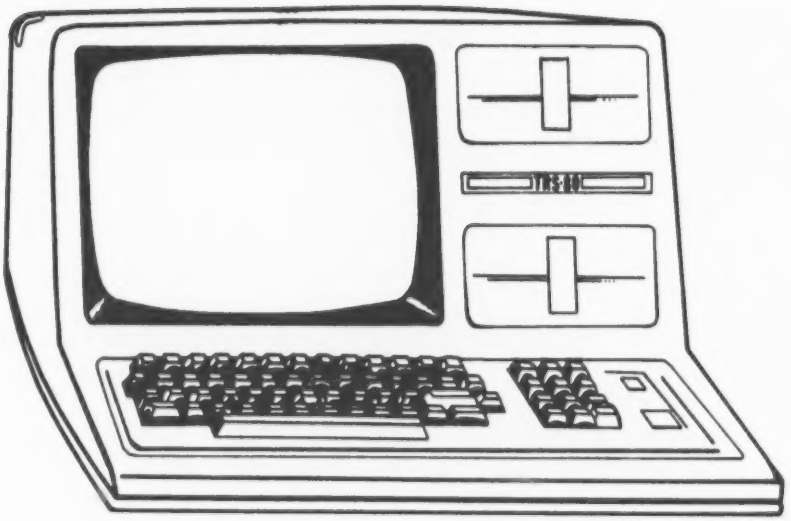
STEPS FOR "BOOTING" COMMODORE MICROCOMPUTERS

1. Ground yourself.
2. Turn on the Commodore microcomputer.
3. Turn on the disk drive.
4. Insert the diskette face up into the slot in drive Ø.
5. Close the door of the disk drive.
6. Press <SHIFT> and <RUN/STOP> at the same time.
7. Make your program selection from the menu on the screen.

The following steps are necessary only if the software is NOT menu-driven.

8. Press <RUN/STOP>.
9. Type CATALOG and press <RETURN>.
10. Select the program you wish to use. Note the exact spelling of its title.
11. Type LOAD "name of the program", 8 and press <RETURN>.
12. Wait until the word READY appears and the blinking cursor returns.
13. Type RUN and press <RETURN>.

COMPUTER REMINDERS



93

STEPS FOR "BOOTING" A TRS-80 MICROCOMPUTER

1. Ground yourself.
2. Turn on the power switch under the right side of the keyboard.
3. Wait until the red light on the disk drive goes off.
4. Insert the diskette face up into the slot in the bottom disk drive.
5. Close the door of the disk drive and press the orange (RESET) button.
6. Wait until the red light on the disk drive goes off and then press the orange (RESET) button again.
7. Make your program selection from the menu on the screen.

The following steps are necessary only if the software is NOT menu-driven.

8. When you see the words "TRSDOS READY" on the screen, type DIR and press <ENTER>.
9. Select the program you wish to use. Note the exact spelling of its title.
10. Type RUN "name of the program" and press <ENTER>.

"BOOTING" MICROCOMPUTERS

I-1-2
Level 1
LA
P.1 of 4

DIRECTIONS FOR "BOOT" THE APPLE GAME:

Cut out the boxes and arrange the steps in order on the game board (p. 4).

Variations:

1. How long does it take to put the boxes in order? Are you faster than your friend?
2. Put the boxes in order on the game board. Remove one box. Ask your friend to identify the missing step.
3. Put the boxes in order on the game board. Mix up two steps. Ask your friend to locate the mix-up.

94

INSERT THE DISKETTE FACE UP INTO THE SLOT IN DRIVE 1	TURN ON THE MONITOR
GROUND YOURSELF	MAKE YOUR PROGRAM SELECTION FROM THE MENU ON THE SCREEN
WAIT UNTIL THE RED LIGHT ON THE FRONT OF THE DISK DRIVE GOES OFF FOR THE FIRST TIME	TURN ON THE POWER SWITCH AT THE BACK OF THE MICROCOMPUTER
CLOSE THE DOOR OF THE DISK DRIVE	

DIRECTIONS FOR "BOOT" THE COMMODORE GAME:

Cut out the boxes and arrange the steps in order on the game board (p. 4).

Variations:

1. How long does it take to put the boxes in order? Are you faster than your friend?
2. Put the boxes in order on the game board. Remove one box. Ask your friend to identify the missing step.
3. Put the boxes in order on the game board. Mix up two steps. Ask your friend to locate the mix-up.

95

TURN ON THE DISK DRIVE	GROUND YOURSELF
PRESS <SHIFT> and <RUN/STOP> AT THE SAME TIME	CLOSE THE DOOR OF THE DISK DRIVE
INSERT THE DISKETTE FACE UP INTO THE SLOT IN DRIVE 0	MAKE YOUR PROGRAM SELECTION FROM THE MENU ON THE SCREEN
	TURN ON THE COMMODORE MICROCOMPUTER

DIRECTIONS FOR "BOOT" THE TRS-80 GAME:

Cut out the boxes and arrange the steps in order on the game board (p. 4).

Variations:

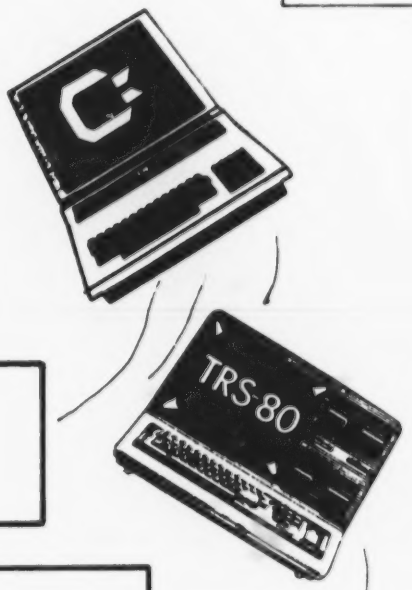
1. How long does it take to put the boxes in order? Are you faster than your friend?
2. Put the boxes in order on the game board. Remove one box. Ask your friend to identify the missing step.
3. Put the boxes in order on the game board. Mix up two steps. Ask your friend to locate the mix-up.

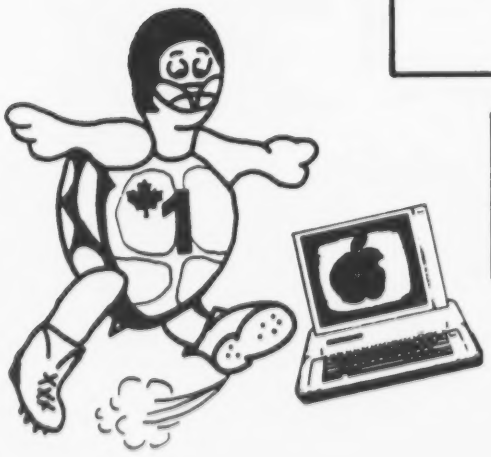
96

WAIT UNTIL THE RED LIGHT ON THE DISK DRIVE GOES OFF	CLOSE THE DOOR OF THE DISK DRIVE AND PRESS THE ORANGE (RESET) BUTTON
MAKE YOUR PROGRAM SELECTION FROM THE MENU ON THE SCREEN	TURN ON THE POWER SWITCH ON THE RIGHT SIDE OF THE KEYBOARD
GROUND YOURSELF	WAIT UNTIL THE RED LIGHT ON THE DISK DRIVE GOES OFF AND THEN PRESS THE ORANGE (RESET) BUTTON AGAIN
	INSERT THE DISKETTE FACE UP INTO THE SLOT IN THE BOTTOM DISK DRIVE

"BOOTING" MICROCOMPUTERS GAMEBOARD

I-1-2
Level 1
LA
P.4 of 4





97

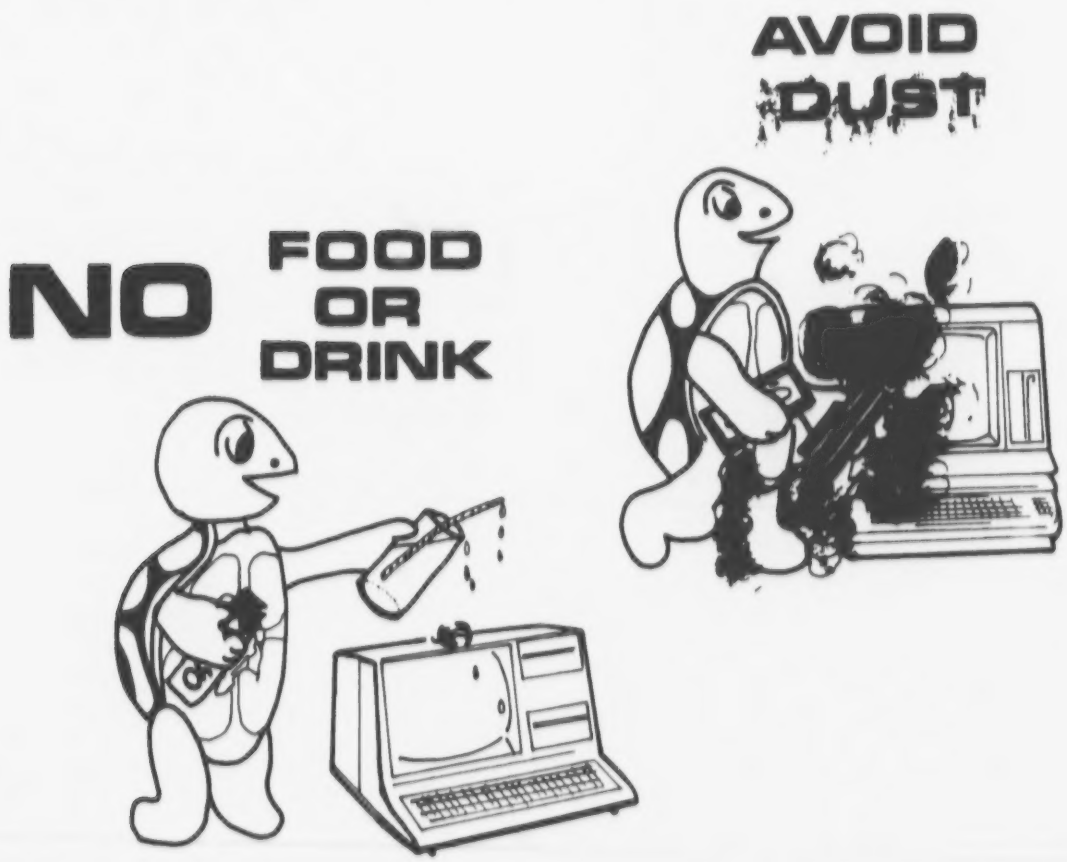
RESPECT and RESPONSIBILITY

I-2-1
Level 1
LA
P.1 of 1

This activity is designed to establish responsibility for computer equipment.

DIRECTIONS:

1. List classroom rules for computer care.
2. Classify your rules under "Computer Care" or "Computer Manners."
3. Make posters to illustrate your rules.

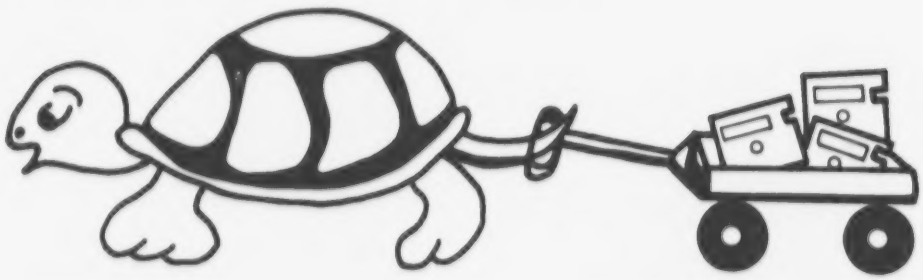


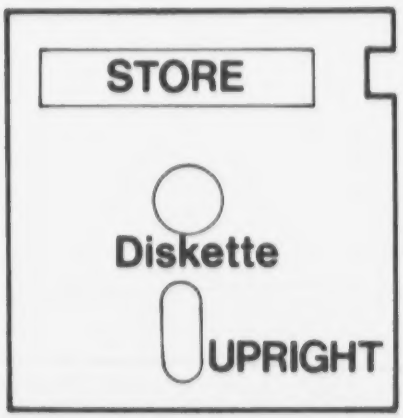
98

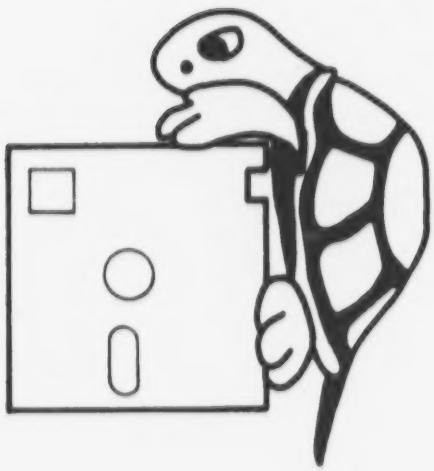
DEALING WITH DISKETTES

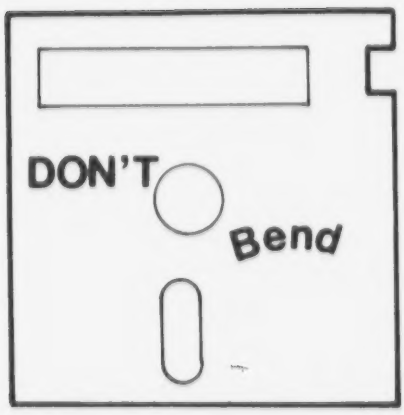
I-2-2
Level 1
LA
P.1 of 2

PREPARE POSTERS TO ILLUSTRATE THE FOLLOWING:

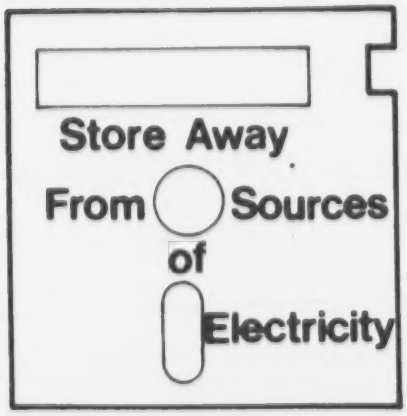


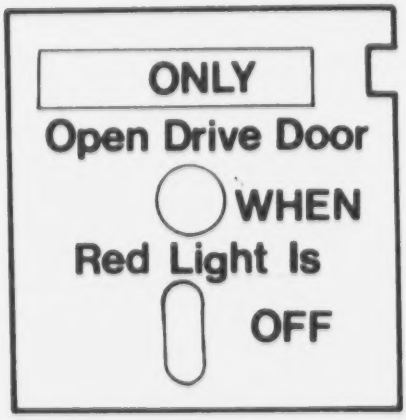





DON'T
Bend

Ground Yourself
Before Handling
Diskettes


Store Away
From
Sources
of
Electricity

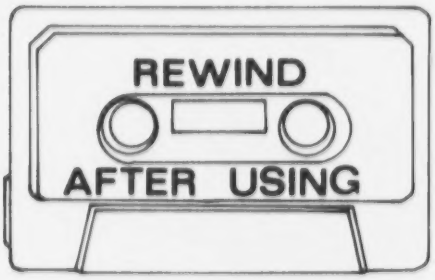

ONLY
Open Drive Door
WHEN
Red Light Is
OFF

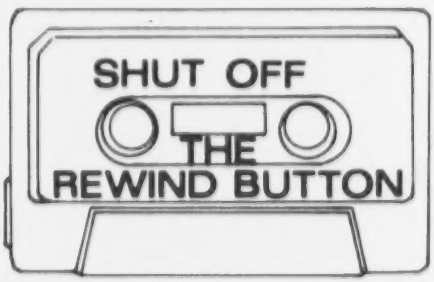
100

CARING FOR CASSETTES

I-2-3
Level 1
LA
P.1 of 1

PREPARE POSTERS TO ILLUSTRATE THE FOLLOWING:

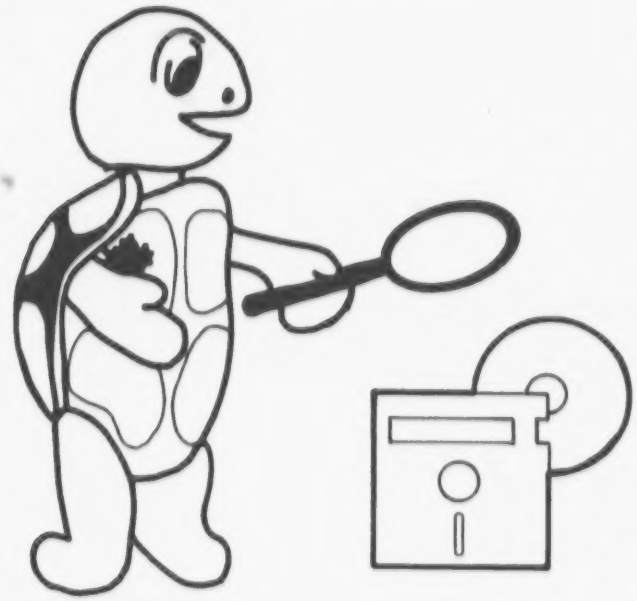




101

DISCOVERING DISKETTES

I-2-4
Level 1
LA
P.1 of 4



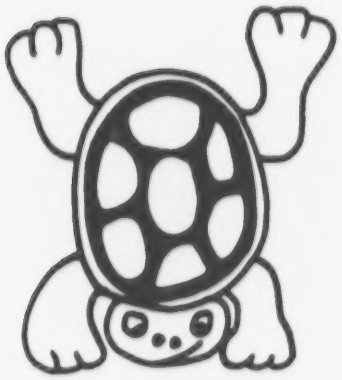
MAKING A DISKETTE

1. Carefully cut out pattern pieces A, B and C.
2. Fold pattern B on the dotted lines. Place piece A inside. Glue the flaps down. Now, the diskette is assembled.
3. Make the diskette jacket by folding pattern C on the dotted lines. Glue down the flaps.

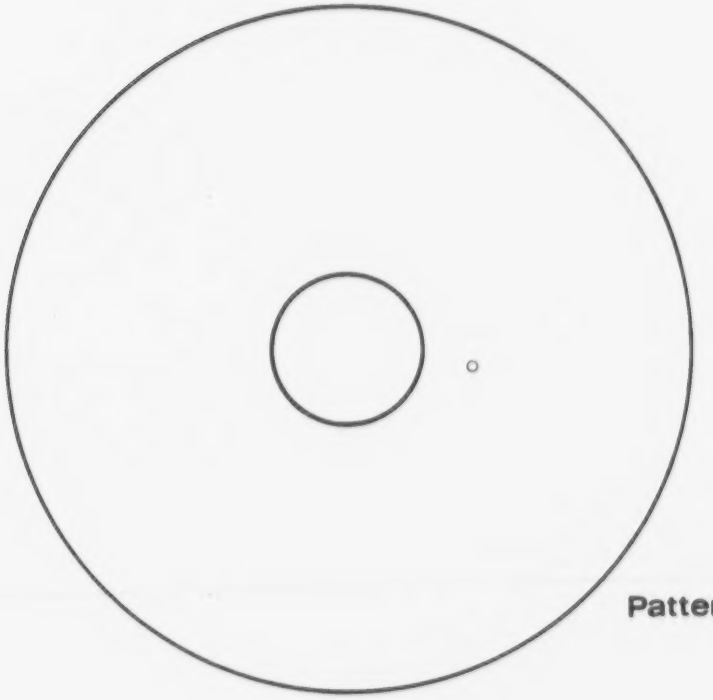
POETRY OR PROSE WRITING

1. Write a poem or short paragraph about how to care for a diskette.
2. Print your poem or short paragraph on the diskette jacket. (Never write on the diskette jacket when the diskette is inside.)
3. Place the diskette inside the jacket.

102

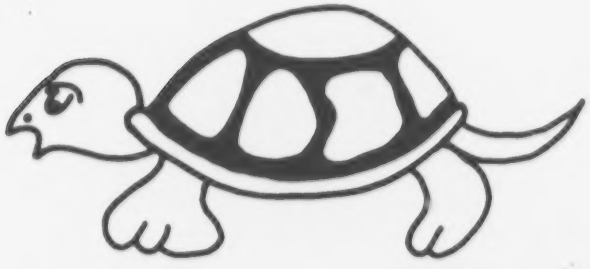


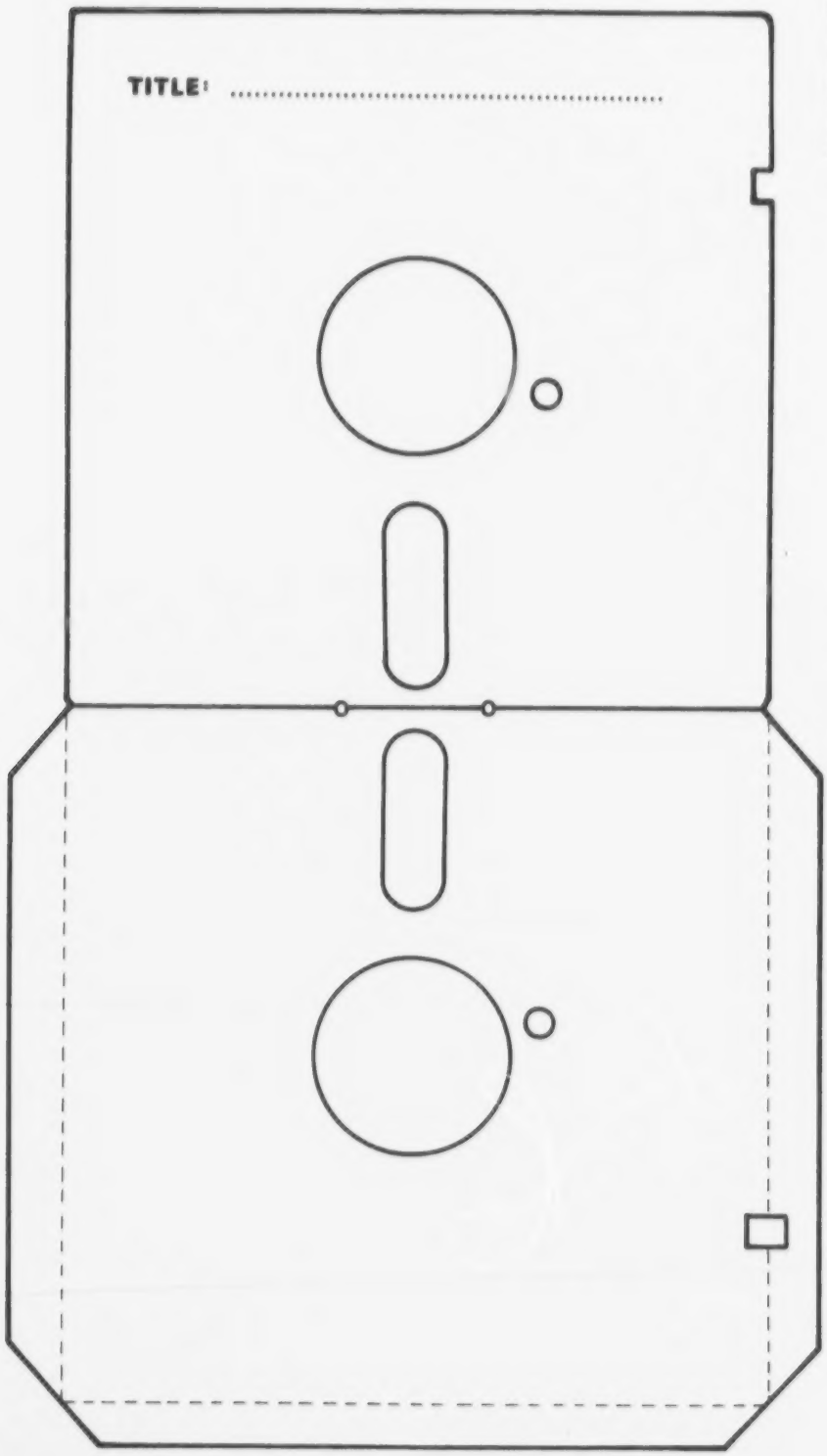
I-2-4
Level 1
LA
P.2 of 4



103

Pattern A

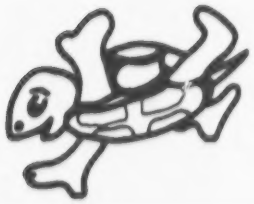




I-2-4
Level 1
LA
P.3 of 4

Pattern B

104



I-2-4
Level 1
LA
P.4 of 4

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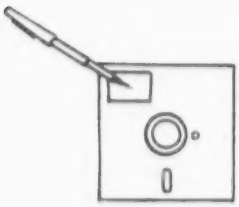
Pattern C

FRAGILE, HANDLE WITH CARE!

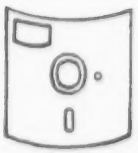
I-2-5
Level 1
LA
P.1 of 1

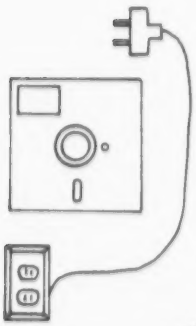
DIRECTIONS: Match each picture with its rule.
Be careful, there are some extras!!



PLACE DISKETTE IN JACKET

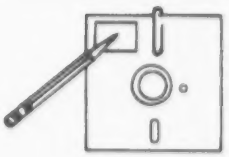
DON'T BEND



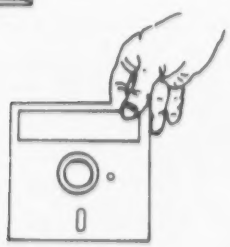


HANDLE DISKETTE BY LABEL

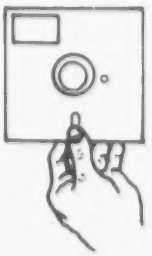
NO FOOD OR WATER



DON'T TOUCH DISKETTE

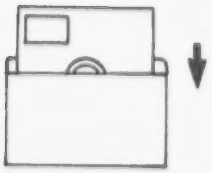


NO PENCILS, NO CLIPS,
NO BALLPOINTS

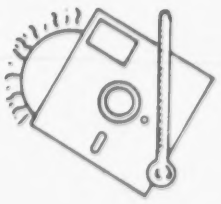


NO SUN, NOT TOO HOT

KEEP AWAY FROM
ELECTRICITY SOURCES



FELT TIP ONLY



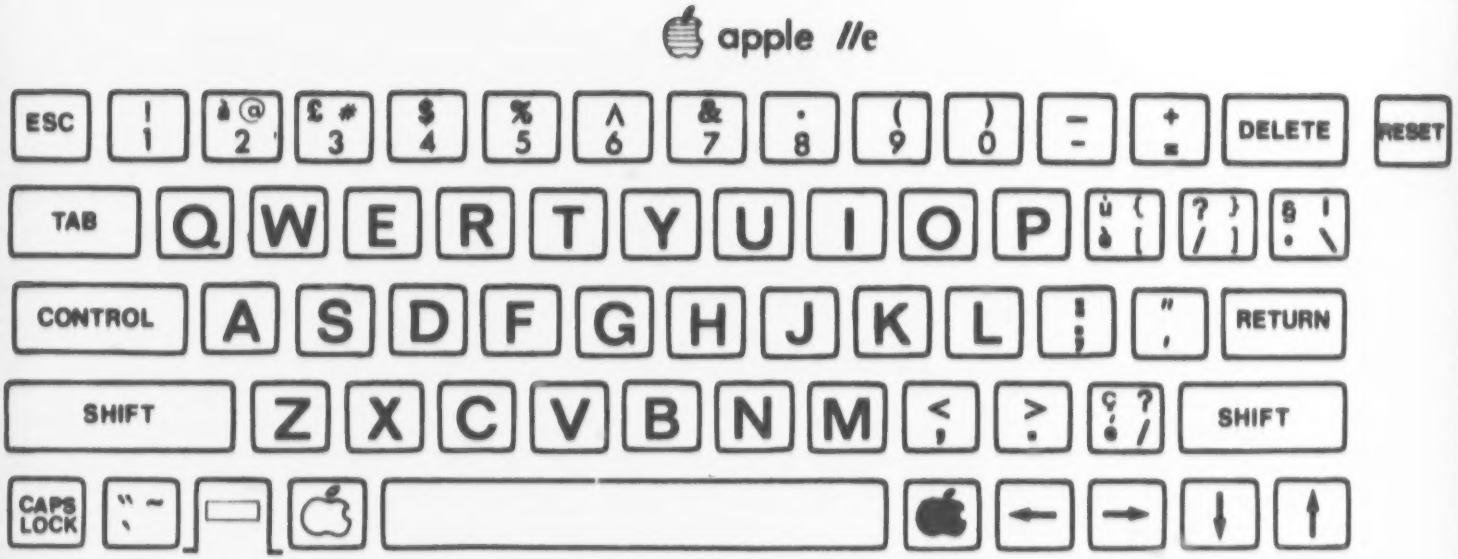
WASH HANDS BEFORE USING

106

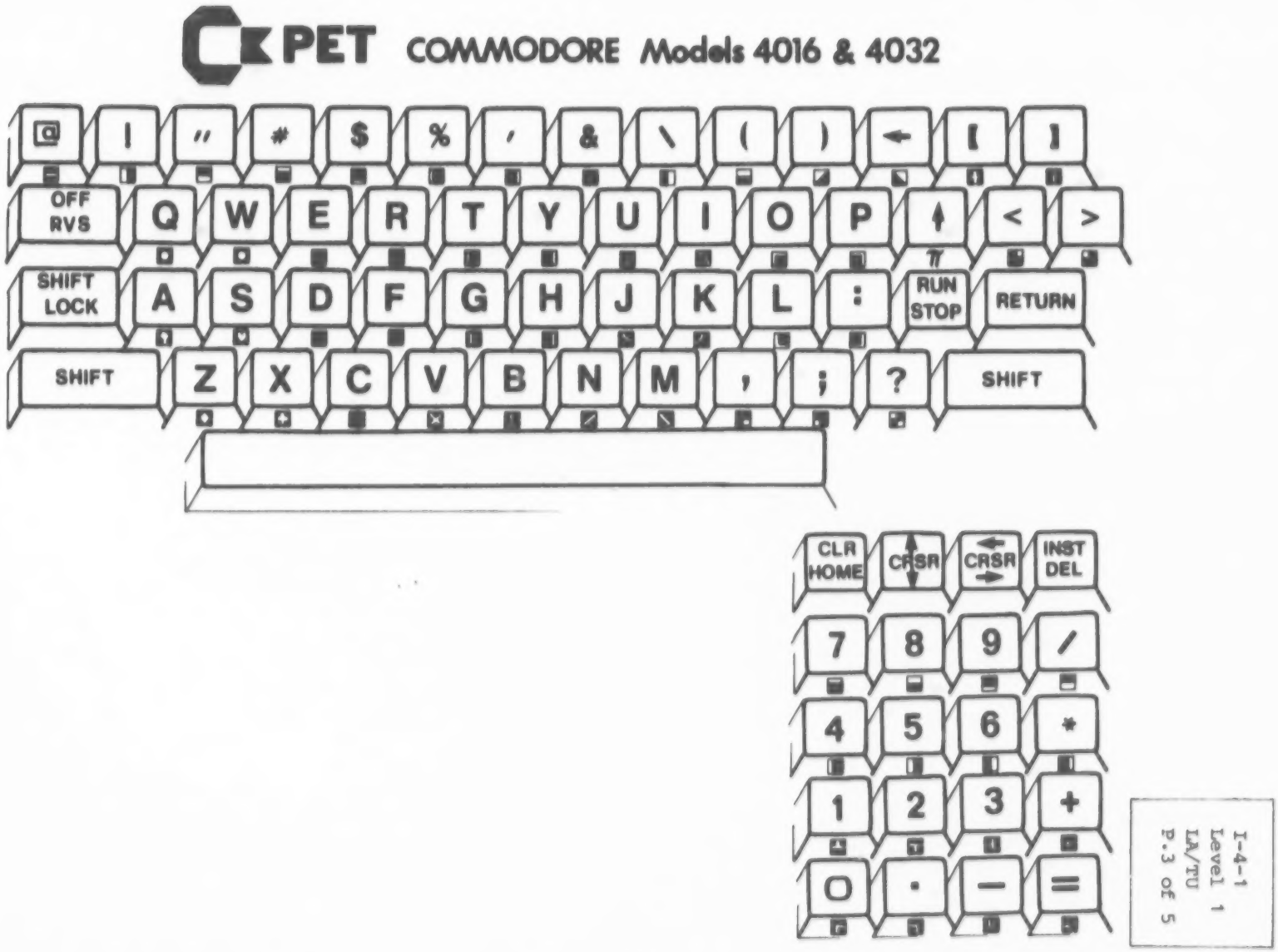
MICROCOMPUTER KEYBOARDS

I-4-1
Level 1
LA/TU
P.1 of 5

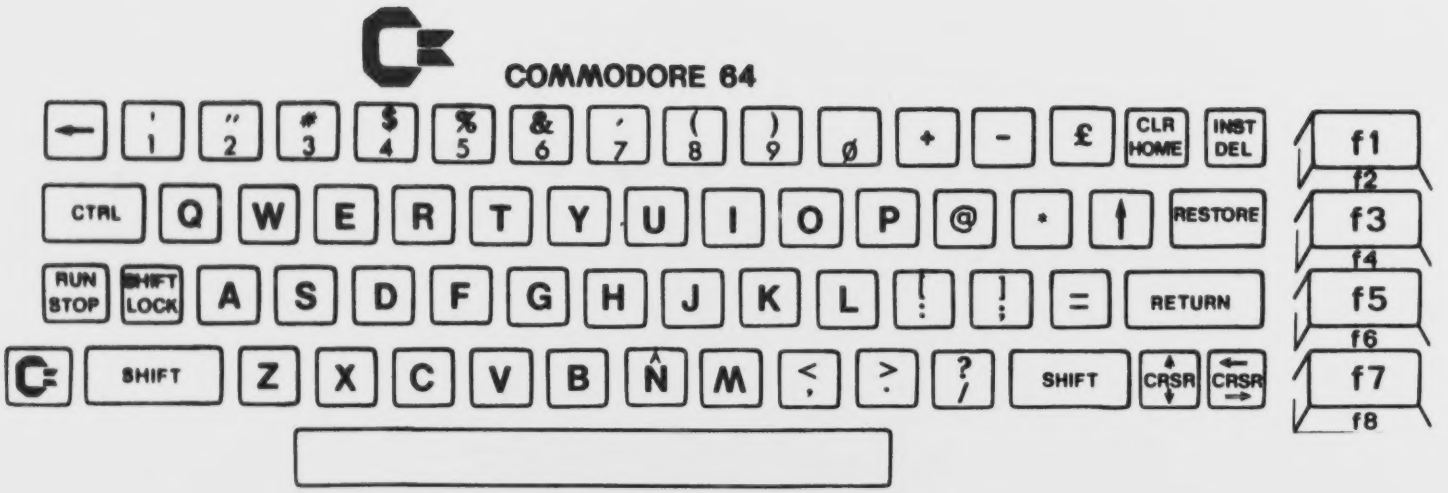
107



I-4-1
Level 1
LA/TU
P.2 of 5


PET COMMODORE Models 4016 & 4032
@ ! " # $ % ' & \ ( ) ← [ ]
OFF RVS Q W E R T Y U I O P ↑ < >
SHIFT LOCK A S D F G H J K L : RUN STOP RETURN
SHIFT Z X C V B N M , ; ? SHIFT
CLR HOME CRSR CRSR INST DEL
7 8 9 /
4 5 6 *
1 2 3 +
0 . − =

I-4-1
Level 1
LA/TU
P.3 of 5



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I-4-1
Level 1
LA/TU
P.4 of 5

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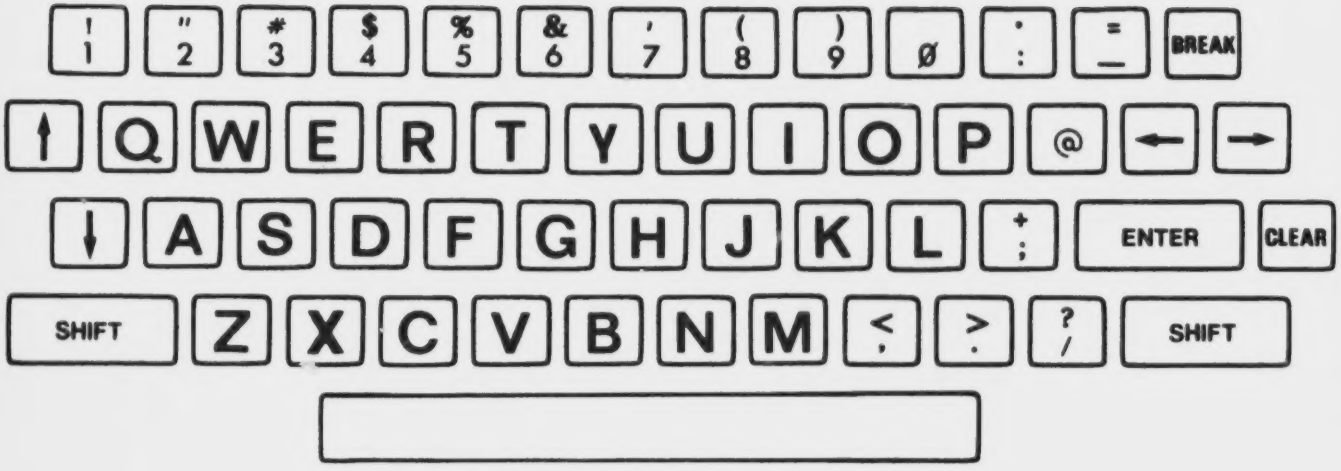
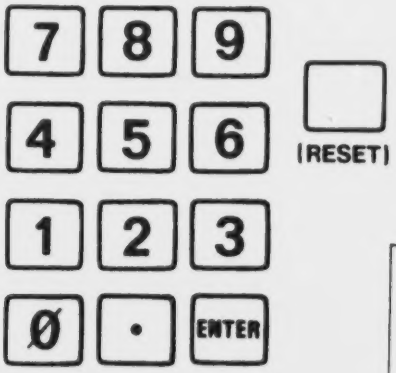
TRS-80 MODEL III



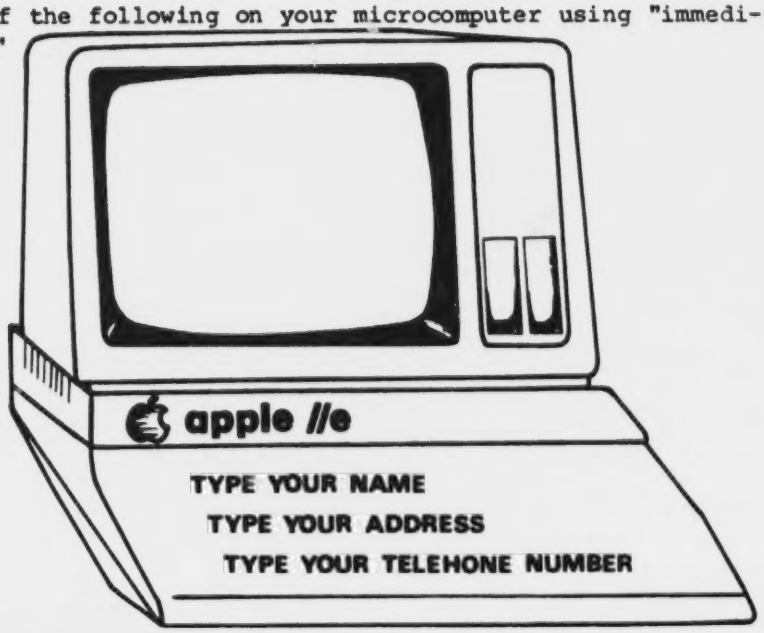


I-4-1
Level 1
LA/TU
P.5 of 5

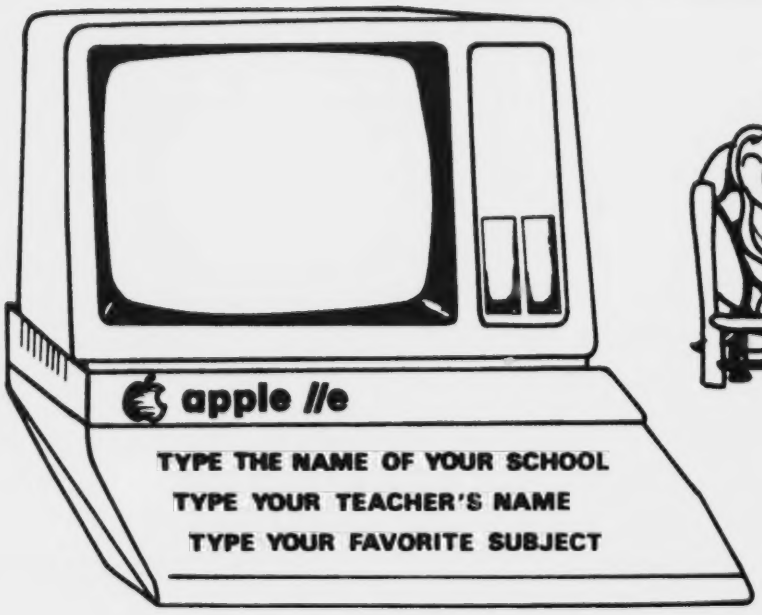
KEYBOARD CHALLENGE

I-4-2
Level 1
H-o
P.1 of 3

DIRECTIONS: Do each of the following on your microcomputer using "immediate mode."

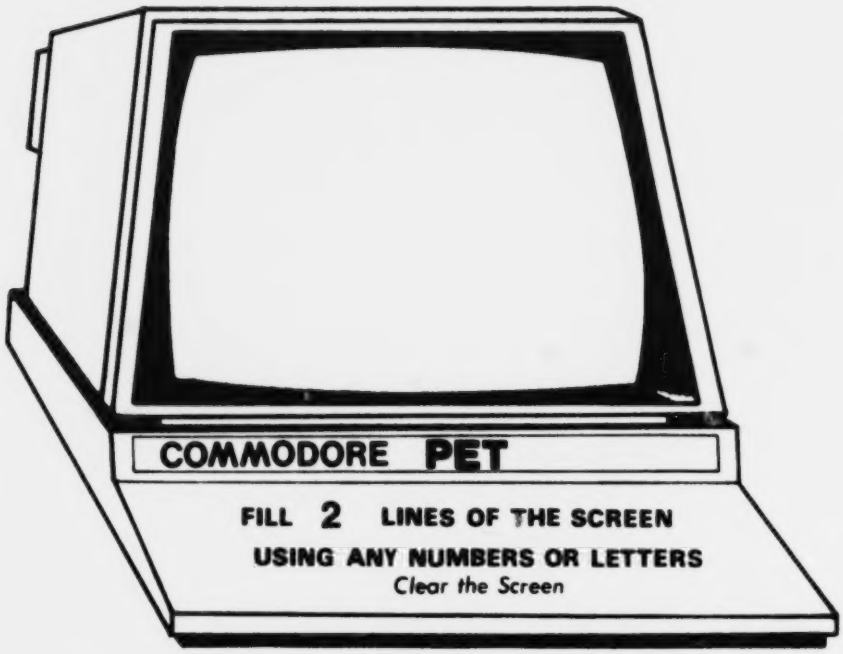


112

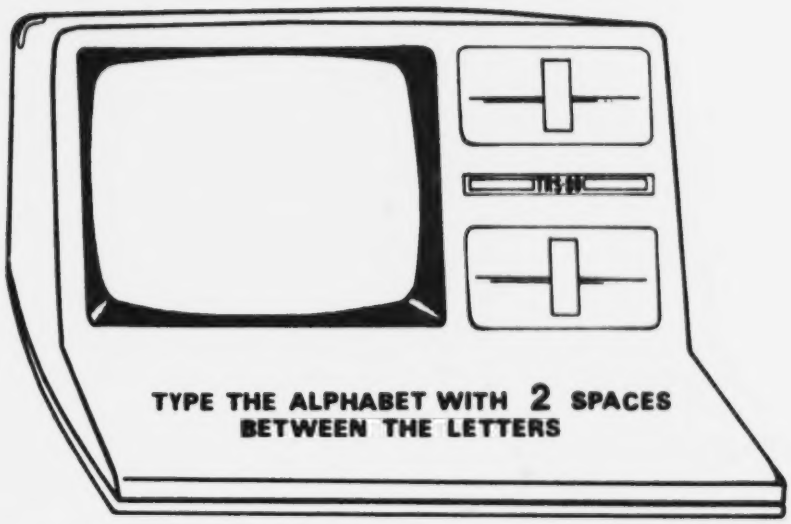


I-4-2
Level 1
H-o
P.2 of 3

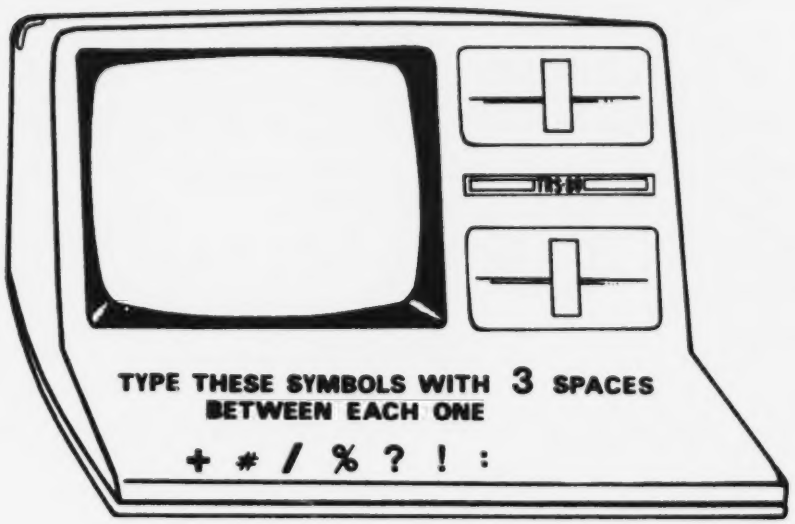
113



I-4-2
Level 1
H-o
P.3 of 3



114

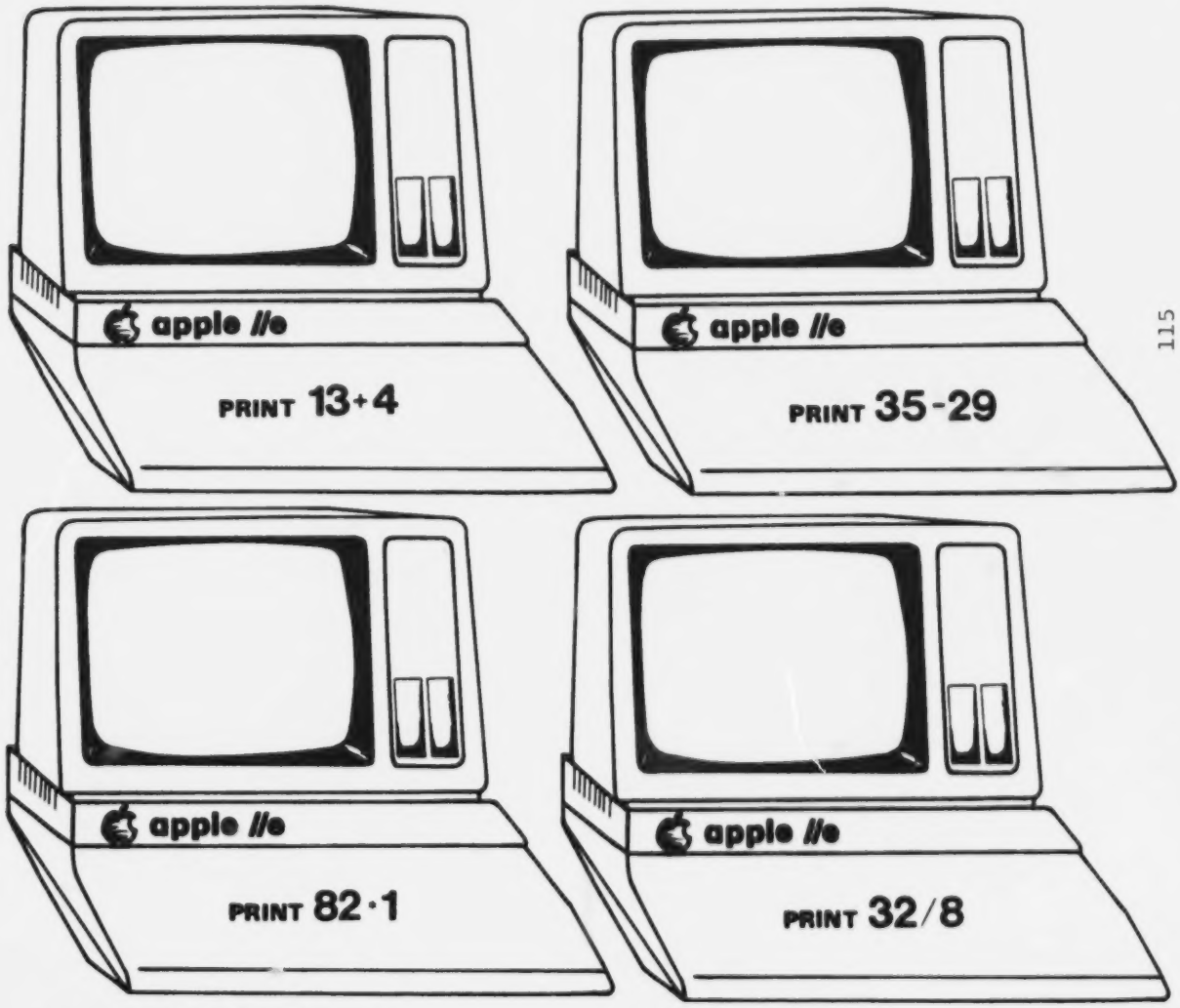


COMPUTER CALCULATING

I-4-3
Level 2
Ma/H-o
P.1 of 3

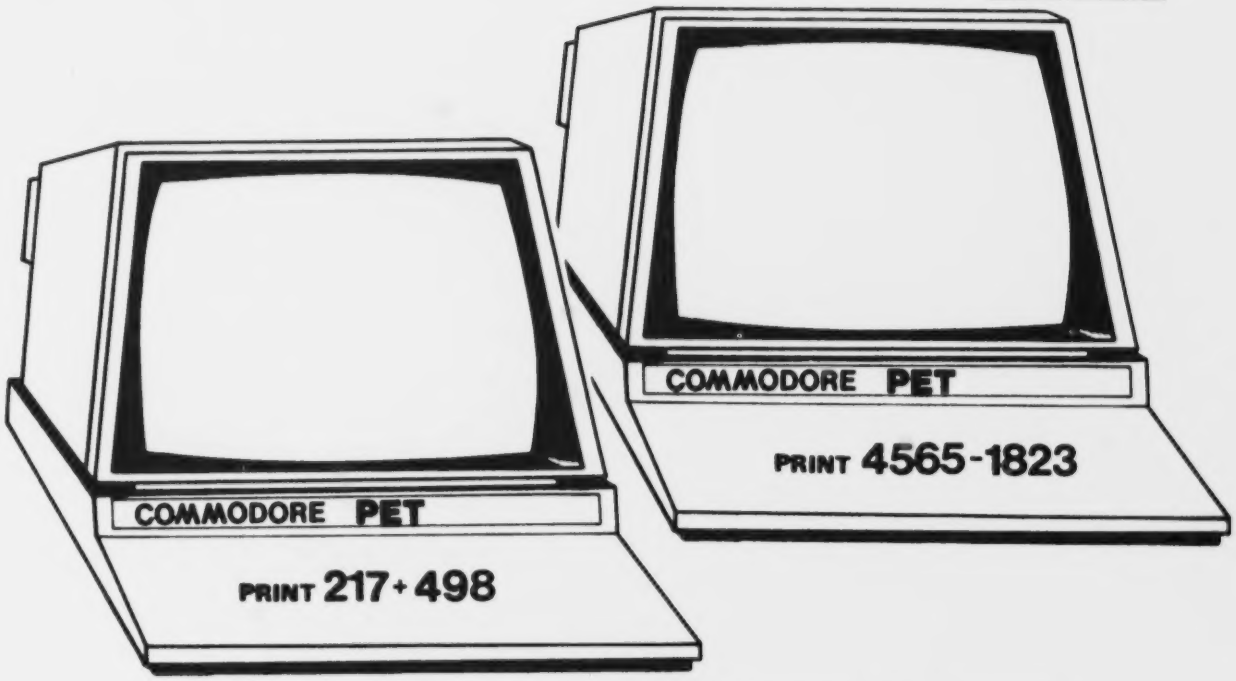
DIRECTIONS:

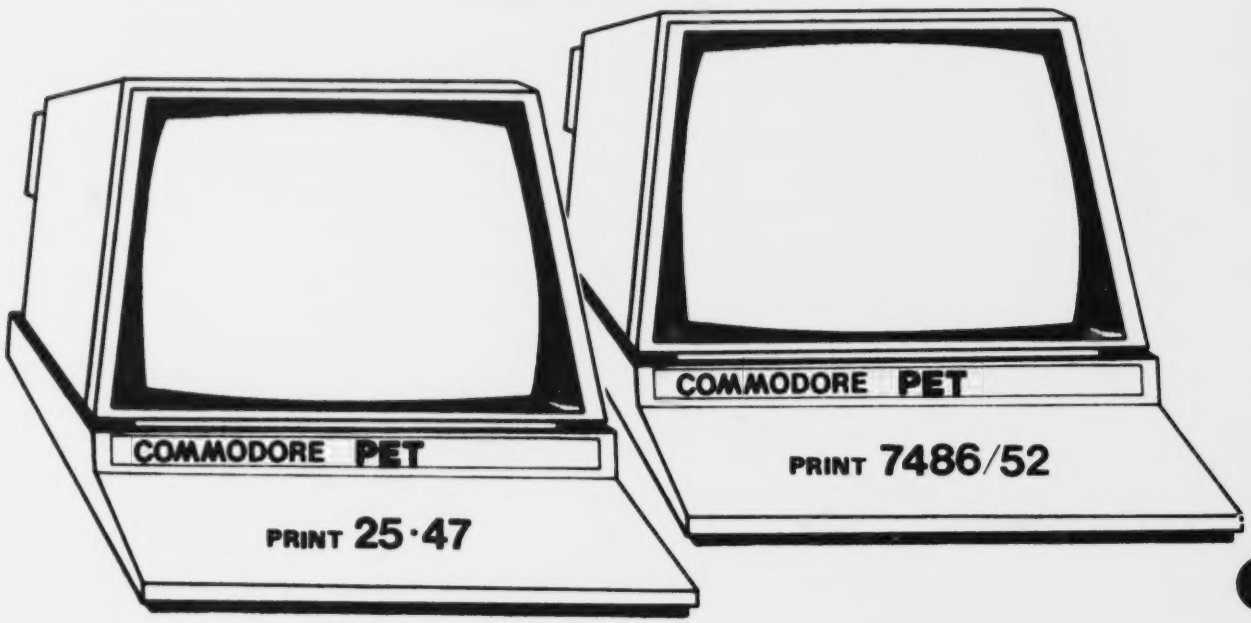
1. Perform each of the following calculations using pencil and paper. Print your answer on the screen.
2. Using a computer, type each problem exactly as shown. Then press < RETURN/ENTER >.
3. Compare your answer with the actual computer output.



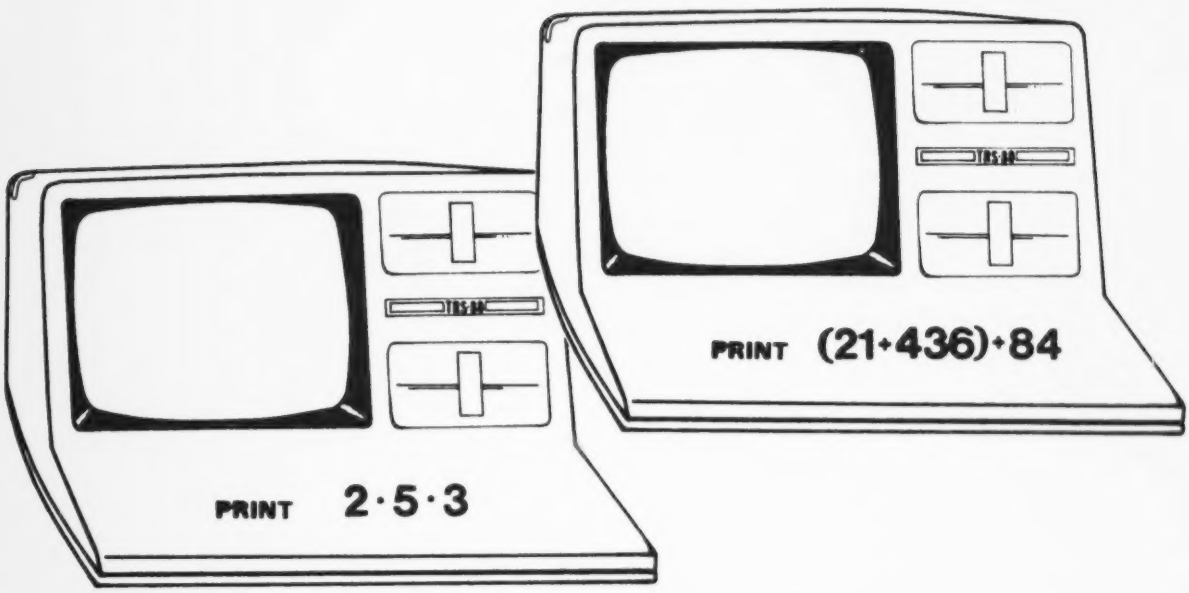
115

* means multiplication (X) / means division (÷)

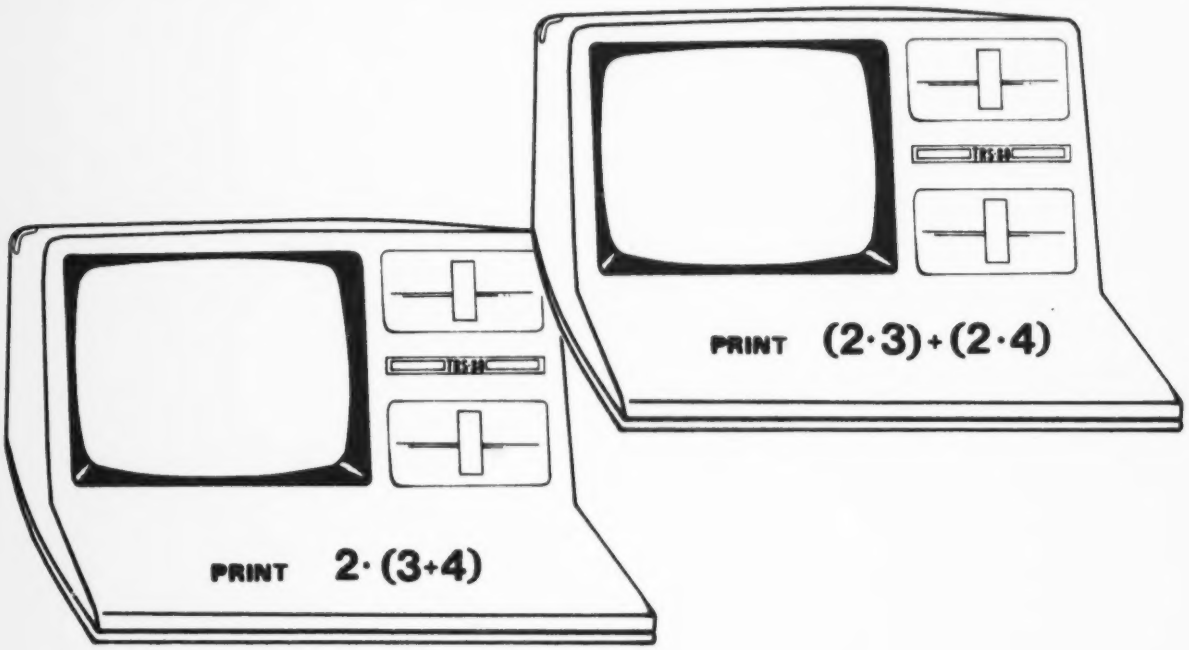

COMMODORE PET
PRINT 4565-1823
COMMODORE PET
PRINT 217+498


COMMODORE PET
PRINT 7486/52
COMMODORE PET
PRINT 25·47

I-4-3
Level 2
Ma/H-o
P.3 of 3



117

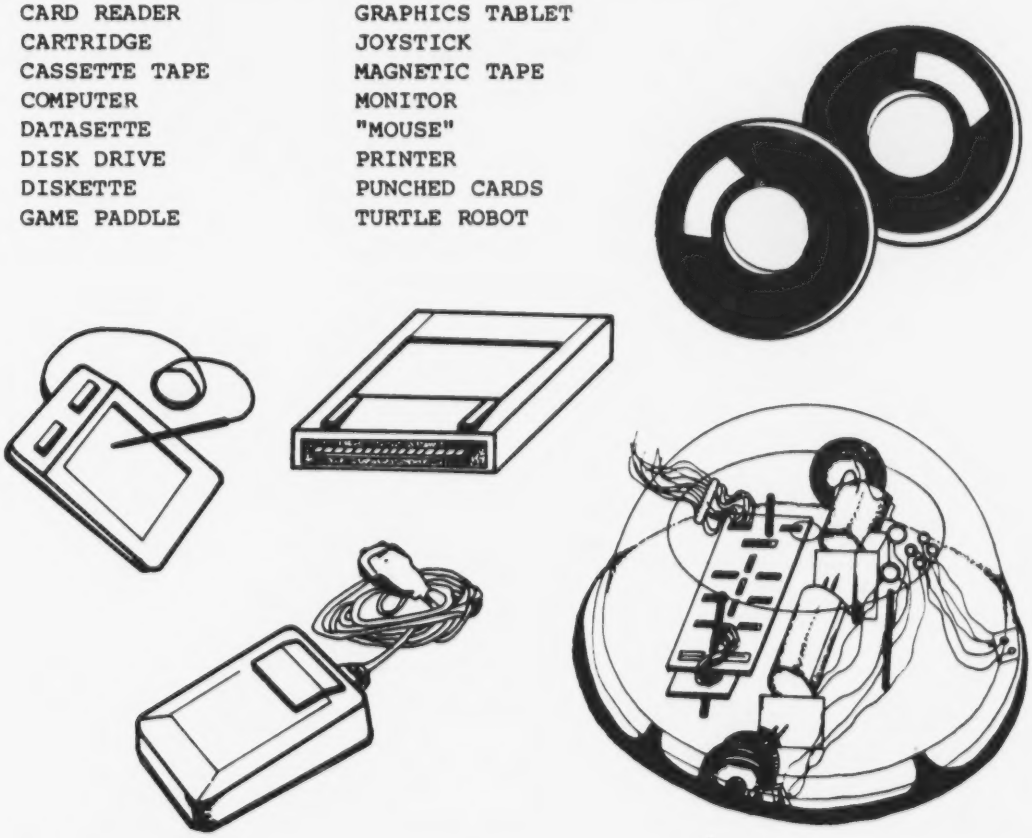


CLASSIFYING HARDWARE AND SOFTWARE

DIRECTIONS:

1. Title one piece of paper "Computer Hardware Devices" and the other "Computer Software Storage Media."
2. Cut out the pictures.
3. Classify each picture as either a computer hardware device or a computer software storage medium.
4. Glue each picture under the appropriate title.
5. Label each picture using the list of words below:

CARD READER	GRAPHICS TABLET
CARTRIDGE	JOYSTICK
CASSETTE TAPE	MAGNETIC TAPE
COMPUTER	MONITOR
DATASETTE	"MOUSE"
DISK DRIVE	PRINTER
DISKETTE	PUNCHED CARDS
GAME PADDLE	TURTLE ROBOT



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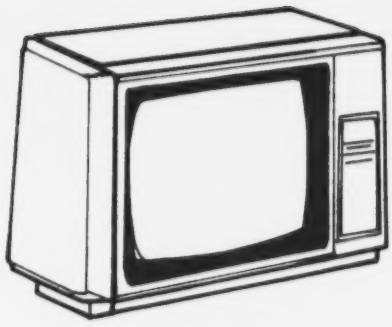
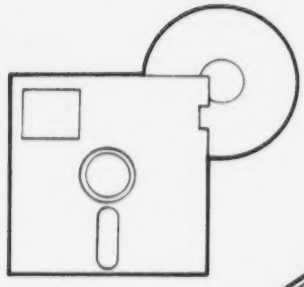
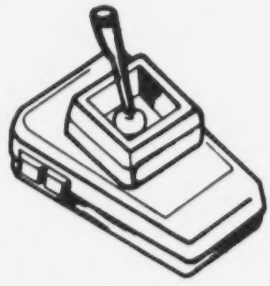
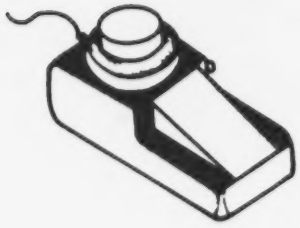
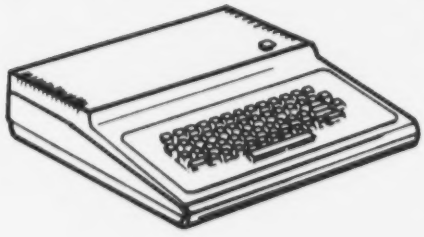
II-1-1
Level 1
LA/Sc
P.2 of 4

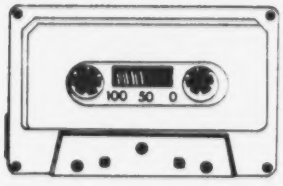


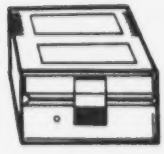


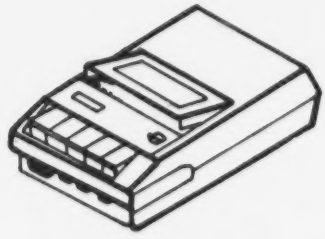


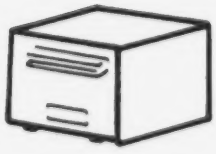


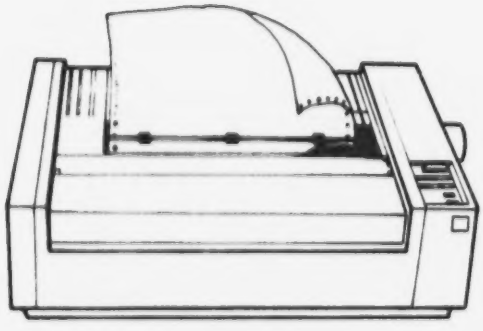


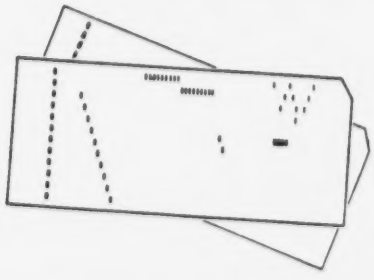












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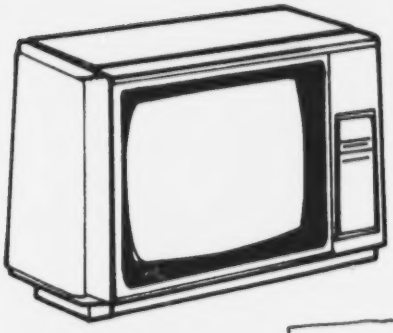
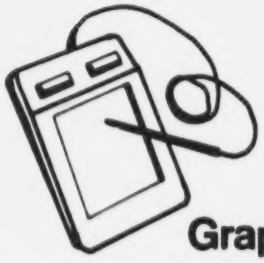
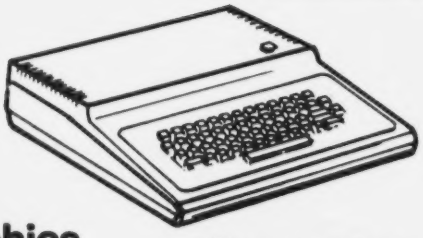
ANSWER KEY TO
"COMPUTER HARDWARE DEVICES"



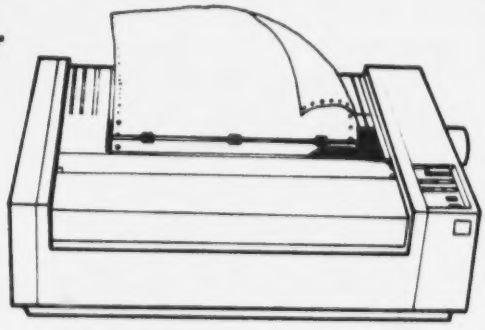
Monitor



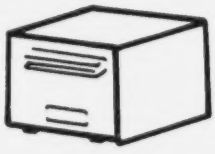
Graphics Tablet



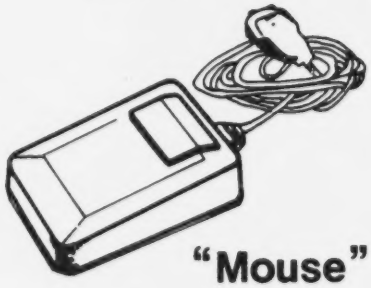
Computer



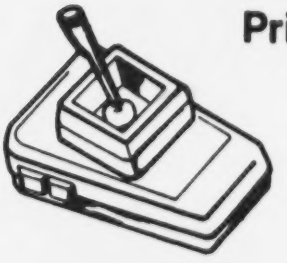
Printer



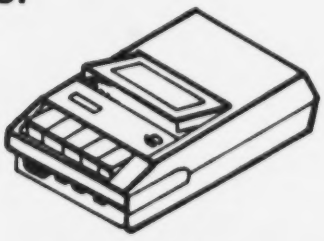
Card Reader



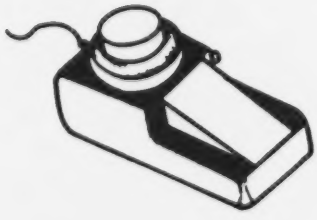
"Mouse"



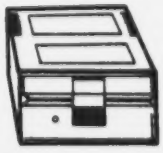
Joystick



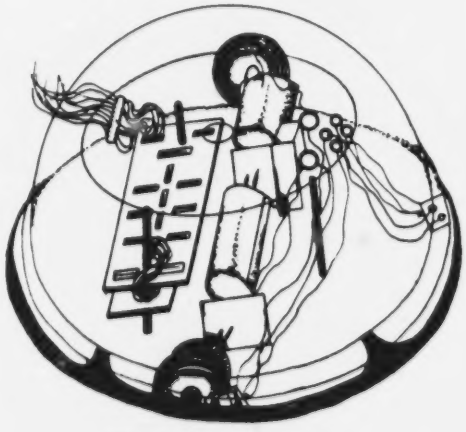
Datasette



Game Paddle



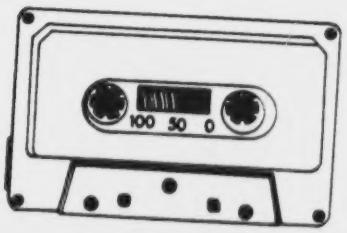
Disk Drive



Turtle Robot

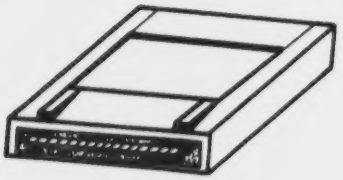
120

ANSWER KEY TO "COMPUTER SOFTWARE STORAGE MEDIA"

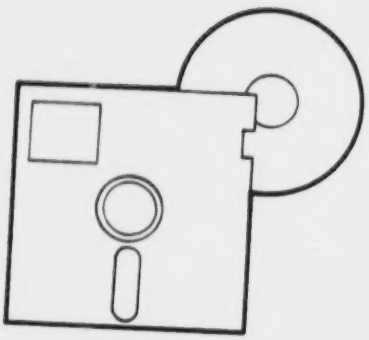


Cassette Tape

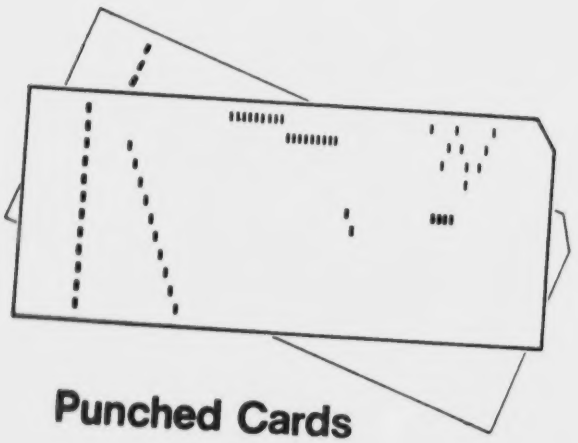
Magnetic Tape



Cartridge



Diskette



Punched Cards

121

SEARCHING FOR WORDS

II-1-2
Level 1
LA
P.1 of 2

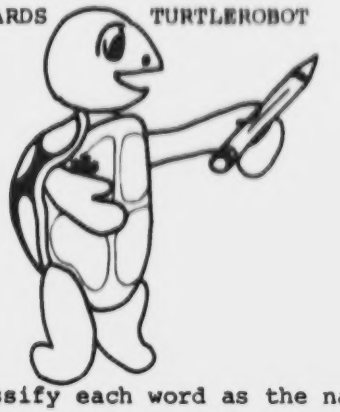
DIRECTIONS:

There are 16 computer related words in this puzzle. Find them.

HERE ARE THE WORDS TO LOOK FOR:

CARDREADER	CARTRIDGE
CASSETTETAPE	COMPUTER
DATASETTE	DISKDRIVE
DISKETTE	GAMEPADDLE
GRAPHICSTABLET	JOYSTICK
MAGNETICTAPE	MONITOR
MOUSE	PRINTER
PUNCHEDCARDS	TURTLEROBOT

T S T I P M J K M O G N G N U P K V P M
W L P D P U A O R T W D C S Q D W C Z Y
G Y X T X H N G Y Z B R G H W I T O U O
J W N L G C X C N S V P K H U S B M B Q
Q C R H B A U R H E T R Z Z Y K L P E V
E M Q D L U M R V E T I I N D D P U D M
F W V C G C Z E Q T D I C O S R S T B Y
J X S C C R C F P H W C C K O I N E Y J
F X O O U A A A C A I V A T X V Z R W B
P R I N T E R P S A D V O R A E K Q S E
M U F U O F Z D H S R D G C D P M T S D
D I S K E T T E R I E T L U A S E U W D
D E E C N P Y F O E C T R E O Z O B V C
C Y E J T G N C B B A S T I W M U H F I
T U R T L E R O B O T D T E D X L U R T
M O N I T O R R Y V L O E A T G D Z A L
D A T A S E T T E A V B R R B A E U Q I
T R L X M K P K H Q G Y Z Z Y L P J V U
O C M Z M K W V F L E G U M R R E E Z W
D H K D V B J Z X E E O N X L M T T Y L



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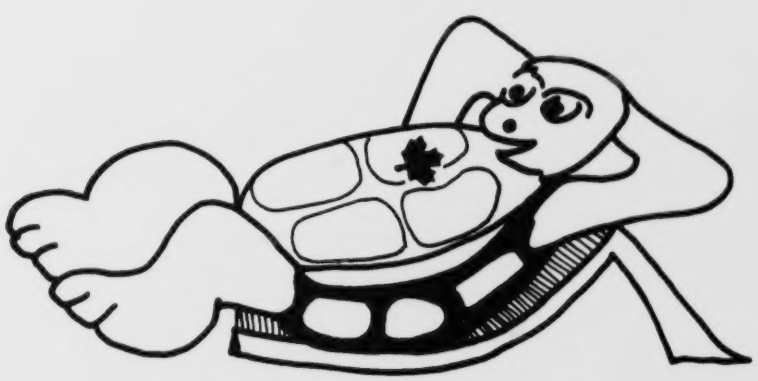
Now, classify each word as the name either of a computer hardware device or of a computer software storage medium:

HARDWARE DEVICES	SOFTWARE STORAGE MEDIA

SOLUTION "SEARCHING FOR WORDS"


```
. . . . P M J . . . . . . . . . . . . . .
. . . . . U A O . . . . . . . D . C . . .
. . . . . N G Y . . . . . . I . O . . .
. . . . G . . C N S . . . . . S . M . . .
. . . . . A . . H E T . . . . K . P . . .
. . . . . M . . E T I . . . D . U . . .
. . . . G . . E . . D I C . . R . T . . .
. . . . C R C . P . . C C K . I . E . . .
. . . . . A A A C A . . A T . V . R . . .
P R I N T E R P S A D . . R A E . . . E
. . . . . D H S R D . . D P . . S .
D I S K E T T E R I E T L . . S E U . . .
. . . . . E C T R E . . O . . . .
. . . . . A S T I . M . . . . .
T U R T L E R O B O T D T E D . . . . .
M O N I T O R . . . . . E A T G . . . . .
D A T A S E T T E . . . . R B A E . . . .
. . . . . L P . . . .
. . . . . E E . . .
. . . . . T . . .
```



123

MICRO-MATH

II-1-3
Level 1
Ma
P.1 of 2

DIRECTIONS:

Solve each of the following problems:

1. There are 5 printers, 7 diskettes, 9 computers and a graphics tablet. How many hardware devices are there?

2. If there are 18 microcomputers and 5 disk drives, how many more disk drives are needed so there is one disk drive for each microcomputer?

3. Tracy and Anna worked on the Apple II computers which have 64K memory. Tracy wrote a program with 39 math questions and Lori wrote a program with 56 math questions. How many math questions did the girls write?

4. Our class had 16 microcomputers with colour monitors. 5 of the monitors were borrowed for a demonstration. How many monitors are left?

5. There are 9 disk drives, 3 monitors, 5 game cartridges and 7 computers. How many hardware devices are there?

6. Jamie saved 17 programs on a diskette on Monday and Brad deleted 4 programs on Tuesday. How many programs are still on the diskette?

7. Luigi used 12 programs in September. He used 26 programs in October. How many more programs did he use in October than September?

8. There are 38 diskettes, 25 tapes and a robot turtle. How many pieces of software storage media are there?

9. There were 2 joysticks, 3 punched cards, 4 tapes, 6 microcomputers and 5 datasettes. How many hardware devices are there altogether?

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ANSWERS TO "MICRO-MATH"

Refer to the classification of hardware devices and software storage media in Activity II-1-1.

1. 5 printers + 9 computers + 1 graphics tablet total 15 hardware devices. The 7 diskettes are considered software storage media.

2. 13 disk devices

3. 95 math questions

4. 11 monitors

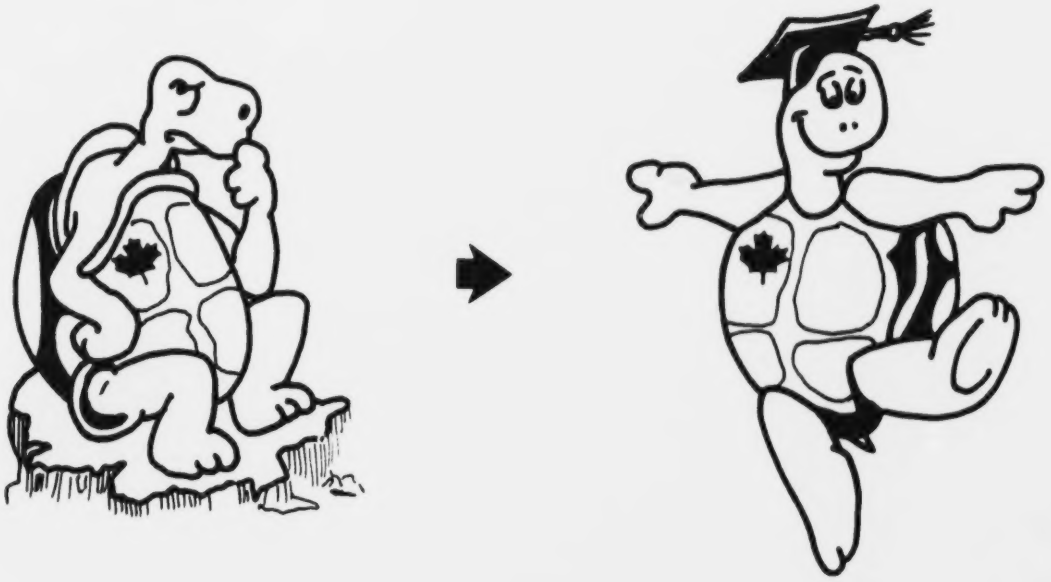
5. 19 hardware devices. The 5 game cartridges are considered software storage media.

6. 13 programs

7. 14 programs

8. 63 pieces of software storage media

9. 13 hardware devices



MORE MICRO-MATH

II-1-4
Level 2
Ma
P.1 of 2

1. There are 8 computers in a computer lab and each computer has 2 shift keys. How many shift keys are there altogether?

2. There were 25 children in the computer class. Each child had 3 turns on the computer. How many turns did the children take altogether?

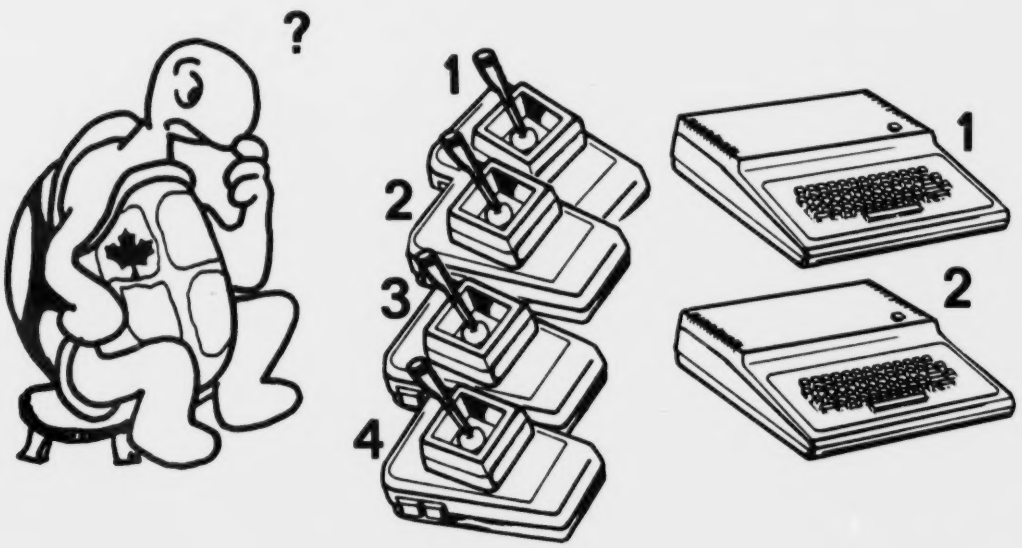
3. There are 6 computers. Each computer has 2 joysticks. How many joysticks are there altogether?

4. There were 24 students. Each student had 10 minutes at the computer. How many minutes were spent on the computers altogether? How many hours would that be?

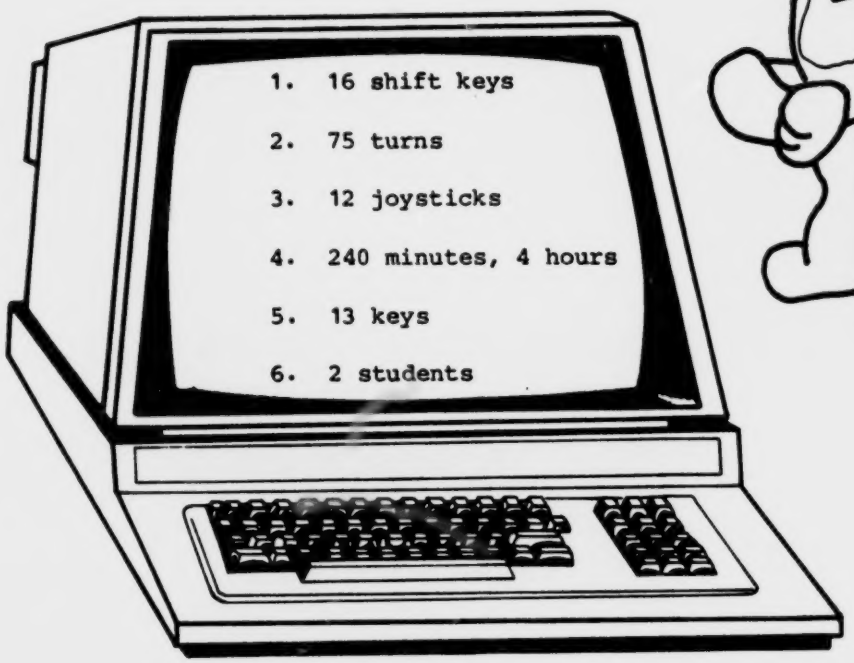
5. There are 52 keys on a computer. If there are 4 rows, how many keys are in each row?

6. There are 24 students and 12 microcomputers in the computer room. How many students will work at each microcomputer?

126



ANSWERS TO "MORE MICRO-MATH"



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WHAT'S IN A COMPUTER ?

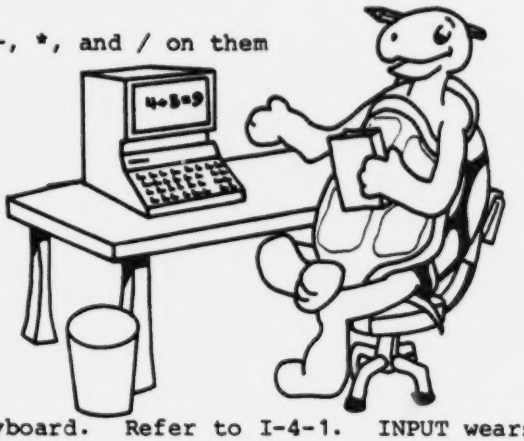
II-2-1
Level 3
LA
P.1 of 1

OBJECTIVE:

This activity is intended to demonstrate the inner workings of a computer.

MATERIAL:

Blank cards and cards with 0 to 9, +, -, *, and / on them
9 students wearing signs
- 1 student wearing USER
- 1 student wearing INPUT
- 1 student wearing CPU
- 5 students wearing MEMORY
- 1 student wearing OUTPUT



DIRECTIONS:

1. Reproduce a large microcomputer keyboard. Refer to I-4-1. INPUT wears this keyboard.
2. Arrange stacks of number cards (0 to 9) and arithmetic operation cards (+, -, *, /) in front of INPUT.
3. USER comes forward and presses a number key on the keyboard (e.g, 4). INPUT selects a 4 card, [4], from the stack and gives it to one cell (person) in MEMORY.
4. USER then presses an arithmetic operation key (e.g., +). INPUT passes the + card, [+], to a second MEMORY cell.
5. USER presses another number key (e.g., 5). INPUT passes the [5] to a third MEMORY cell.
6. MEMORY writes 4 + 5 on a blank card. This card is passed to CPU.
7. CPU selects two blank cards and writes = on one and 9 on the other. These are passed to the open memory cells.
8. Now MEMORY has five full cells.

[4] [+] [5] [=] [9]

9. The MEMORY cell containing 9 writes 9 on a blank card and passes it to OUTPUT.
10. OUTPUT displays the answer.

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INPUT, PROCESS, OUTPUT

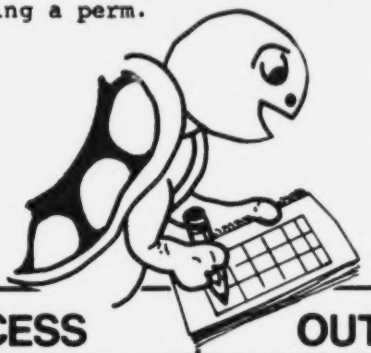
II-2-2
Level 2
LA
P.1 of 2

Many activities in everyday life provide examples of input, process, and output. Consider the example of getting a perm.

INPUT: straight hair

PROCESS: person perms hair

OUTPUT: curly hair



Complete the following chart.

INPUT	PROCESS	OUTPUT
Musical Instrument	Playing	
Flat Tire		Inflated Tire
	Sharpening	Sharp Skates
Dirty Car	Washing	
Dirty Carpet		Clean Carpet
Dirty Chalkboard		Clean Chalkboard
	Freezing	Popsicle
	Heating	Popcorn

Select a "daily activity" and draw cartoons to show input, process and output.

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Sample solutions for INPUT, PROCESS, OUTPUT include:

INPUT	PROCESS	OUTPUT
		music
	inflating	
dull skates		
		clean car
	vacuuming	
	erasing	
Kool-Aid		
popping corn kernels		

This answer sheet could be used as the worksheet for more advanced students, in which case multiple answers are possible.

THE FIVE SENSES

II-2-3
Level 2
Sc
P.1 of 1

DIRECTIONS:

Identify ways through which people receive input or exhibit output. Write answers under the appropriate heading.

Human Input...

Human Output...

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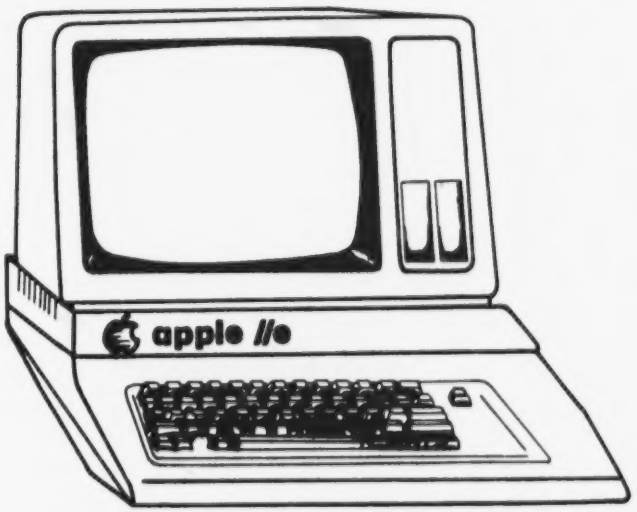
II-2-4
Level 2
LA/Sc
P.1 of 1

COMPUTER INPUT/OUTPUT

DIRECTIONS:

Identify ways by which computers receive input or provide output. Place answers under the appropriate heading.

Computer Input...



Computer Output...

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DANNY DUNN and the HOMEWORK MACHINE

CHAPTER FOUR

MEET MINIAC

Professor Bullfinch's laboratory was a long, low structure at the rear of the house, reached by a short hallway. It was crowded and cluttered with equipment, but at one end a large space was clear. Here, there was a curved desk on which were a typewriter and a microphone. A high panel at the back of the desk was filled with tiny light bulbs. There were a number of flat, square buttons, each with a colored panel above it. And beyond the desk was an oblong, gray metal cabinet, about the size of a large sideboard, with heavy electric cables leading to it.

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"Short for 'miniature automatic computer,' " Danny explained. "Gosh! it's exciting. The Professor finished work on it yesterday. You know, scientists have been trying to make these electronic brains smaller. The Professor has invented a new type of tiny switch and a narrower magnetic tape. Those made it possible for him to build a computer as small as this."

"It doesn't look so small," Joe remarked.

"Dr. Aiken's Mark I computer, at Harvard, the first of the so-called giant brains, filled a whole room," said the Professor.

Joe was eyeing the machine in fascination. "So that's one of those mechanical brains," he said. "Is it thinking now?"

"No, Joe," said the Professor. "It only thinks when we ask it questions."

"You mean you can talk to it?"

"Yes, that is one of my improvements. You speak into the microphone, there on the desk, and it types its answers on this electric typewriter."

"Kind of spooky, isn't it?" said Joe, in awe. "I wonder what would happen if you sang into the microphone? Would it type do-re-mi?"

"That's a very interesting idea," said the Professor. "Perhaps we'll try it when I get home. Meantime--uh--you can be rehearsing."

"Professor," Irene said shyly, "could we--could we ask it a question? Just to see how it works?"

Professor Bullfinch stroked his chin. "I don't see why not. Of course, Danny knows its general operation--he has seen me working on it for more than a year."

"Go ahead, Irene," Danny said. "You try. Ask it one of our homework problems."

The Professor snapped a couple of switches. From the cabinet, a steady soft humming came. Several colored lights went on.

"Talk into the microphone, Irene," he said. "Speak slowly and clearly so that Miniac can understand you and translate your words into electrical impulses."

"I understand." Irene stepped close to the desk--or console, as it was called. "It seems strange to ask questions of a machine, doesn't it?" With a slightly nervous quaver in her voice, she said into the microphone. "Um . . . John buys 20 yards of silk for thirty dollars. How much would 918 yards of silk cost him?"

The Professor pressed one of the flat keys. There was a brief pause. Several tiny lights blinked, then a green light flashed on, and the typewriter began to click as if a ghostly hand were striking keys.

"$1,377.00," it wrote. And after a second or two, it added, "And worth it."

Joe blinked. "Hey! How does the machine know that?"

"Well," said Professor Bullfinch, "the computer has several different sections. There's the communications console, this desk through which the operator can talk to the machine and the machine can answer. Then there's an arithmetic unit that can work out sums, and a unit that can do comparisons and logical problems. And there's a memory unit in which all its information is stored. It has hundreds of tables and facts in its memory banks. Each fact is stored as an electrical pattern on magnetic tape, so altogether they take up very little room. The machine can look into its memory and tell you whether the price is right."

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Irene breathed a long sigh. "It's--it's fantastic, like science fiction," she said. "A machine that can work all sorts of problems, give you answers to anything you want to know? It's kind of Superman!"

The Professor shook his head. "No, my dear," he said. "It is only a kind of supertool. Everything in this machine is inside the human head, in the much smaller space of the human brain. Just think of it--all the hundreds of thousands of switches, core memory planes, miles of wire, tubes--all that's in the big case and in this console--are all huge and awkward compared to the delicate, tiny cells of the human brain which is capable of doing as much as, or more than, the best of these machines. It's human brain which can produce a mechanical brain like this one."

"The computer can reason," he went on. "It can do sums and give information and draw logical conclusions, but it can't create anything. It could give you all the words that rhyme with moon, for instance, but it couldn't put them together into a poem."

"Ha! I feel better," Joe said. "People still have something the machine hasn't got."

"That's right. It's a wonderful, complex tool, but it has no mind. It doesn't know it exists."

Danny had been bending over the console, peering at it. Now he said, "Look, Professor! The red light is on. That means something's wrong, doesn't it? I'll turn off the power--"

He reached for the switch marked POWER OFF. Before he could touch it, the Professor caught his hand. "Danny," he said, "there you go again, jumping to conclusions. You must not be so headstrong. Now, think again."

Danny blushed. "Oh, yes," he said. "Now I remember. That red light means the typewriter has finished writing. It's the other, larger red light at the top that means electrical trouble."

"Exactly. Remember, my boy--a scientist takes nothing for granted."

"I will remember. I'm sorry, Professor. I was just excited--like you were a while ago. I wasn't thinking."

Professor Bullfinch rested his hands on the boy's shoulders. "I trust you, Dan," he said. "But you must not forget that this is not a toy. It's an electronic brain, a complicated instrument."

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Danny nodded. "What do you want me to do?" he asked humbly.

"You can finish feeding all these tables and data into it. I'll leave the material right here on the console. You can service the machine every morning; you know how to do that. And if you come across interesting material in the weekly Science News Letter, or Scientific American, you can feed it into the machine. You have the code tables--"

"Yes Professor."

Irene put in, "Professor Bullfinch, I'm very interested in science. You know, my father, Dr. Miller, has taught me a great deal. Do you think perhaps I could--well, help Danny, once in a while, if he doesn't mind?"

"I don't mind," Danny said.

"Of course you can, my dear." Professor Bullfinch smiled at the girl. You may be a good influence on him." Then he turned to Danny and put an arm around the boy. "I know you'll be careful."

"I will, Professor. Honest."

"But-hum!--I know you have a habit of jumping right into things and thinking about them afterward. I want you to promise me one thing, and one thing only, Dan."

"Sure, Professor. What is it?"

"I don't think I can change you into a person who is less headstrong. But I want you to promise me that whenever you get one of your sudden, exciting, and interesting ideas for an experiment--"

"Yes?"

"I want you to count up to a million by thousands."

"Gosh!" said Joe. "That'll take him an hour."

"Yes, I know. That's just it," said the Professor. "Well, Danny?"

"Okay, Professor Bullfinch," said Danny soberly. "I promise."

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Excerpted from Danny Dunn and the Homework Machine, J. W. Williams and R. Abroshkin, New York: McGraw-Hill Book Co., 1958. (Courtesy McGraw-Hill Ryerson Limited.)

QUESTIONS TO ACCOMPANY

DANNY DUNN and the HOMEWORK MACHINE

(Courtesy Doreen Hildebrand
Bertrun E. Glavin Elementary School
River East School Division No. 9)

I. Factual Knowledge

1. Use each word below in an interesting sentence:
   a) laboratory
   b) oblong
   c) midget
   d) fascination
   e) awe

2. Look up each word in the dictionary and write out its meaning:
   a) translate
   b) headstrong
   c) humble
   d) maniac
   e) gravely

II. Comprehension

1. What job did the Professor give Danny to do? Describe his chores in detail.

2. Why was Joe confused between maniac and miniac?

3. Why does the phrase "midget giant" sound so confusing? Think up five other word pairs that give the same strange impression.

4. When Irene spoke into the microphone, what did miniac do with the sounds her voice made?

5. How is the machine's brain different than the human's brain? What is the machine unable to do?

6. Why did the Professor tell Danny to count up to a million by thousands whenever he got a new idea for an experiment?

III. Application

Computer Word Search for "Danny Dunn and the Homework Machine"

M Y S N Q I T Z X F G Q E O Z
G I R S T C O N S O L E P D U
Y P N X F E U L Q R L U K A Y
B B Z I P G V G A R Y K I T P
N W I T A P M B E H A G U A W
V O H D C C Z T R P E T H I G
T D S L J M I C R O P H O N E
F U Y Z B R S S P V W M I E I
A Z O U W E O M E A N A J H A
S Y H E L L P O T R N F X F V
E W P B T H L Q N A V E D B F
V Y A C O M P U T E R I L A L
T C Z M M R D Z I Z W F C J N
C O D E K C B H L F N Z D E V
N R I G R E H D F E W R B M C

There are 10 words here - can you find them?

Here are the words to look for:

CABLES	CODE
COMPUTER	CONSOLE
DATA	MICROPHONE
MINIAC	PANEL
SERVICE	TYPEWRITER

Solution:

M . . . . . .
. I . . . C O N S O L E . D .
. . N . . . . A .
. . . I . . . . . R . . . T .
. . . . A . . . E . . . . A .
. . . . . C . T . . . . . .
. . . . . M I C R O P H O N E
. . . . . R S S P . . . . . .
. . . . W E . . E A . . . . .
. . . E L . . . . R N . . . .
. . P B . . . . . V E . . .
. Y A C O M P U T E R I L . .
T C . . . . . C . .
C O D E . . . . . E .
. . . . . .

IV. Analysis

Two pioneers leading to the development of computers were Blaise Pascal and Joseph Jacquard. Do a research project on one of these men. Include information about when and where they lived, their early lives and their contribution(s) to the development of technology.

V. Synthesis

1. Design a robot that will do a chore for you.

2. Select an everyday item such as a pencil, door lock or chair. Imagine that the item selected has been computerized. Using your knowledge of computerized technology, explain how it would work and include a diagram or blueprint.

3. If you could have a homework machine help you with one subject in school, which subject would it be? Why?

4. Finish this story:

   I had a strange and troubled sleep. When I finally awoke, I knew something was different. As I went down for breakfast I realized that my entire family had turned into robots . . .

VI. Evaluation

Many people today are concerned because computers are taking over to such a great extent. Some are worried that people will even lose their jobs to a computer.

1. Do you think this will happen?
   Why or why not?

2. If it did happen, what should we do about it?

COMPUTER TRIVIA

II-5-1
Level 1
LA
P.1 of 2

Find computer trivia related to:

1. speed of operation
2. accuracy
3. repeated operation
4. storage of large quantities of data

Here are some to get started:

- The amount of memory a computer has is expressed in numbers of K (kilobytes). 16 K of memory is about the same as 16 000 letters of the alphabet. That is the same as ten typewritten pages of words in a book.

- If technology and productivity in other industries had progressed at the same rate as computer technology, an around-the-world airline flight would take 24 minutes, and a standard-size car would get 800 kilometres per litre.

- If you could take a three foot step every nanosecond (billionth of a second), in one second you could walk around the world 23 times. (A nanosecond is to a second what a second is to 30 years. And a picosecond is to a second what a second is to 31 710 years.)

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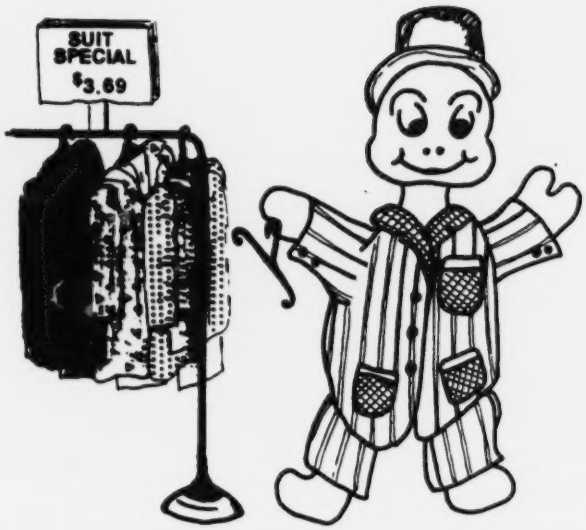
- Twenty-five years ago, it cost $1.26 to do 100 000 multiplications by computer. Today it costs less than a penny.

If the cost of other things had gone down the way computing costs have, you'd be able to buy sirloin steak for about 2¢ a kilogram, a good suit for $6.49, a four bedroom house for $3 500.00, a standard-size car for $200.00, an around-the-world airline trip for $43.00.



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- Thousands and thousands of switches fit on a silicon chip. They can do one billion additions each second. In 1983, the X-MP, made by Cray Research in Minneapolis, Minnesota was the world's fastest computer. The X-MP can do a billion arithmetic problems in just one second.

- According to computer scientist Christopher Evans, if cars had evolved as quickly as computers, you could buy a super-deluxe Rolls-Royce today for under three dollars! It would get three million miles to the gallon. And it would be as powerful as the ocean liner QE2.

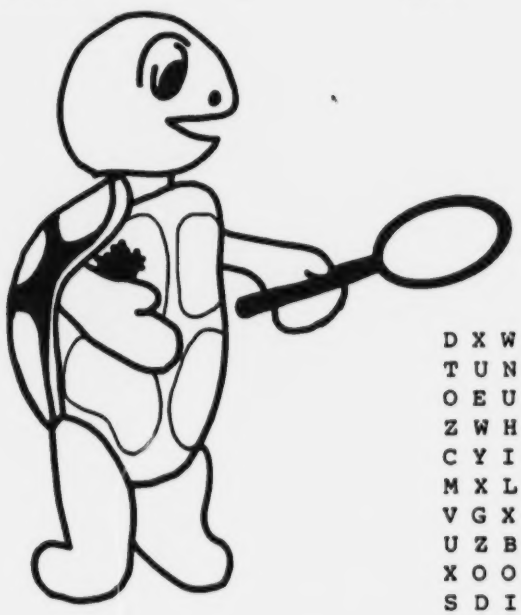
COMPUTER HISTORY WORD SEARCH

III-1-1
Level 3
LA
P.1 of 2

DIRECTIONS:

Words which are associated with computer history are hidden in the puzzle below. The words are printed horizontally, vertically, diagonally and even backwards in the puzzle. Find the following 20 words:

ABACUS	AIKEN	BABBAGE
BURROUGHS	CHIP	CIRCUIT
ECKERT	ENIAC	HOLLERITH
JACQUARD	LEIBNIZ	LOVELACE
MAUCHLY	MICROCOMPUTER	NAPIER
PASCAL	SILICON	STONEHENGE
TRANSISTOR	TUBE	



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D X W D S U C A B A Z S O S X R M A U L
T U N U I B O K R R D A U K J H K Y Y A
O E U E L K T O F E X K X Y Z P F P Z G
Z W H N I T R R U X C N Y E A K A M K W
C Y I L C Q E W J A M K B E L E D V P V
M X L F O C K G I E J A R G O G O R X X
V G X H N V C N W E P R R X D W T U W Q
U Z B F C N E K I A O O K O U R D B A W
X O O D J U H L U S T X B D Q X E T T J
S D I Z A R A T A S T U V Y G I B O L J
J C R A C E T M I C R O C O M P U T E R
T F X F Q I V S V R E H N I Y E T D I W
R P M S U P N O O V E U N E V C H L B F
R X J C A A Z U R X B L G U H N S C N J
Y E R M R N G D T P Q A L I K E O X I J
U I V T D H I Y W D B M P O J F N K Z C
C G B L S I I Y Z B B V A M H S Z G D V
A E B S L A C S A P Q M F S D M E Y E H
I J G I Y H D B G H Q M W I I Y M S R M

III-1-1
Level 3
LA
P.2 of 2

SOLUTION TO
"COMPUTER HISTORY WORD SEARCH"

```
. . . . S U C A B A . . . . . .
. . . . I . . . . . . . . . . .
. . . . L . T . . . . . . . . .
. . . . I . R . . . C . . . . .
. Y . L C . E . . A . . . . . .
. . L . O . K . I . . . . . . .
. . . H N V C N . . . . R . . .
. . . . C N E K I A . O . . . .
. . . . J U H L . S T . B . . . E . . .
. . . . A R A T A S T U . . . . B . L .
. . . . C E T M I C R O C O M P U T E R
. . . . Q I . S . R E . N . . . T . I .
. . . . U P N . O . E . . E . C . . B .
. . . C A A . U . . . L G . H . . . N .
. . R . R N G . . . . A L I . E . . I .
. I . T D H . . . . B . P O . . N . Z .
C . . . S . . . . B . . . . H . . G . .
. . . . L A C S A P . . . . . E .
. . . . . B . . . . . . . . . . .
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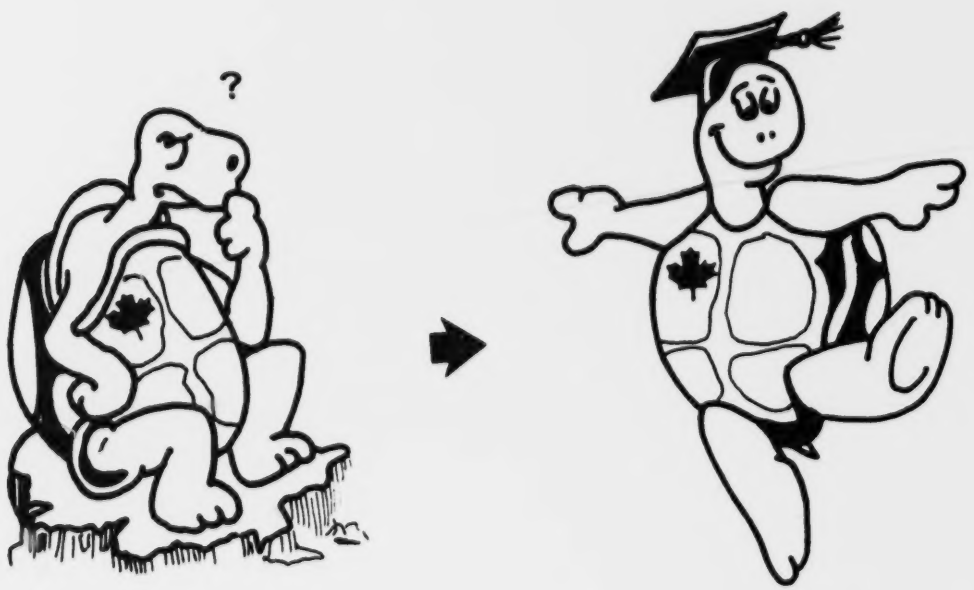
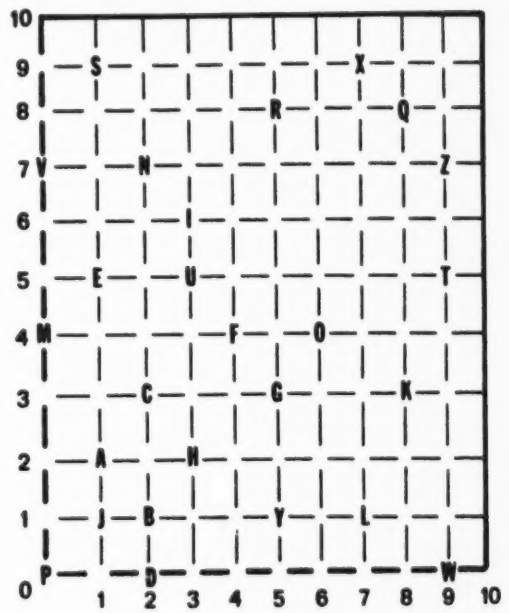


WHO AM I?

III-1-2
Level 3
Ma
P.1 of 2

DIRECTIONS:

Use the following grid to locate the letter represented by each coordinate pair. Write the letter in the space provided. When you finish, you should have some information about a famous person in computing.



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___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
(1,9) (3,2) (1,5) (2,0) (1,5) (0,7) (1,5) (7,1) (6,4) (0,0) (1,5) (2,0)

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
(9,5) (3,2) (1,5) (1,5) (1,9) (1,9) (1,5) (2,7) (9,5) (3,6) (1,2) (7,1)

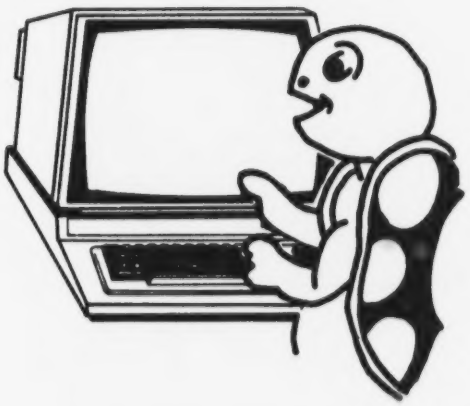
___ ___ ___ ___ ___ ___ ___
(3,6) (2,0) (1,5) (1,2) (1,9) (6,4) (4,4)

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
(0,0) (5,8) (6,4) (5,3) (5,8) (1,2) (0,4) (0,4) (3,6) (2,7) (5,3)

Who Am I?

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
(1,2) (2,0) (1,2) (7,1) (6,4) (0,7) (1,5) (7,1) (1,2) (2,3) (1,5)

ANSWERS FOR "WHO AM I?"



S	H	E		D	E	V	E	L	O	P	E	D
(1,9)	(3,2)	(1,5)		(2,0)	(1,5)	(0,7)	(1,5)	(7,1)	(6,4)	(0,0)	(1,5)	(2,0)

T	H	E		E	S	S	E	N	T	I	A	L
(9,5)	(3,2)	(1,5)		(1,5)	(1,9)	(1,9)	(1,5)	(2,7)	(9,5)	(3,6)	(1,2)	(7,1)

I	D	E	A	S		O	F
(3,6)	(2,0)	(1,5)	(1,2)	(1,9)		(6,4)	(4,4)

P	R	O	G	R	A	M	M	I	N	G
(0,0)	(5,8)	(6,4)	(5,3)	(5,8)	(1,2)	(0,4)	(0,4)	(3,6)	(2,7)	(5,3)

Who Am I?

A	D	A		L	O	V	E	L	A	C	E
(1,2)	(2,0)	(1,2)		(7,1)	(6,4)	(0,7)	(1,5)	(7,1)	(1,2)	(2,3)	(1,5)

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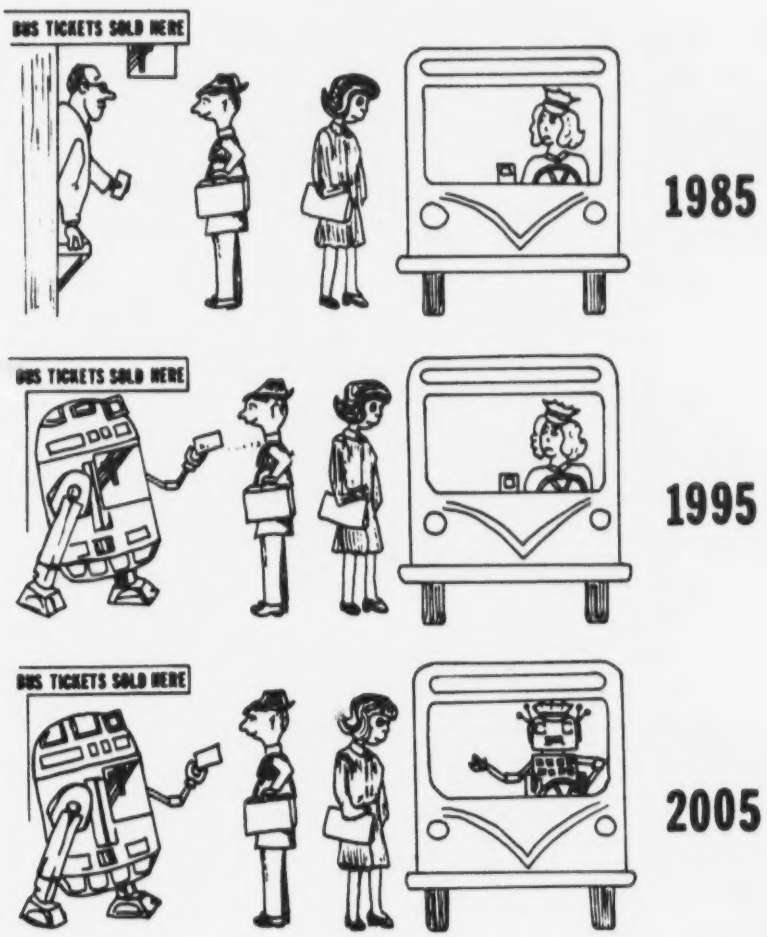
III-3-1
Level 3
LA/SS
P.1 of 2

IS THIS COMING?

DIRECTIONS:

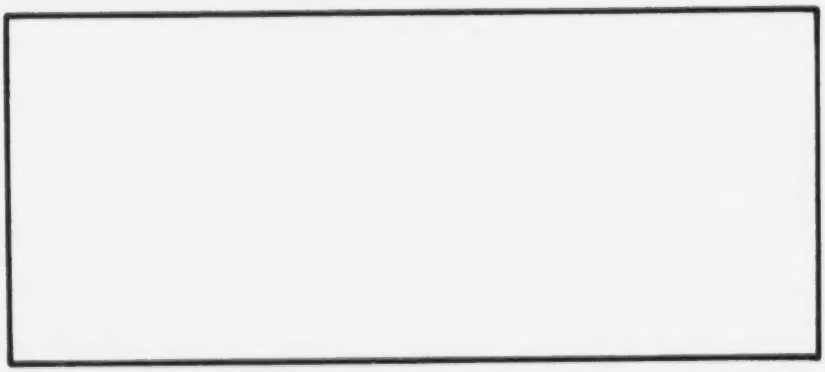
Examine the following cartoon. Discuss technological developments based on the trends depicted. In the space on the next page, prepare your own cartoon showing technological advances from 1985, 1995, and 2005. Do you feel that these developments are likely to occur? What impact will these trends have on your life?



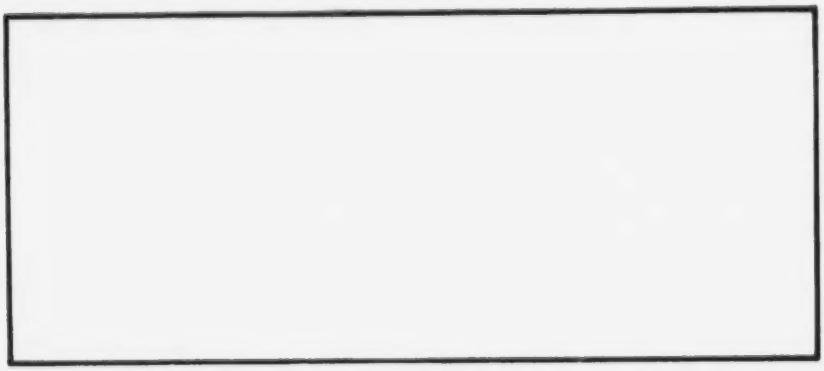
147

IS THIS COMING ?

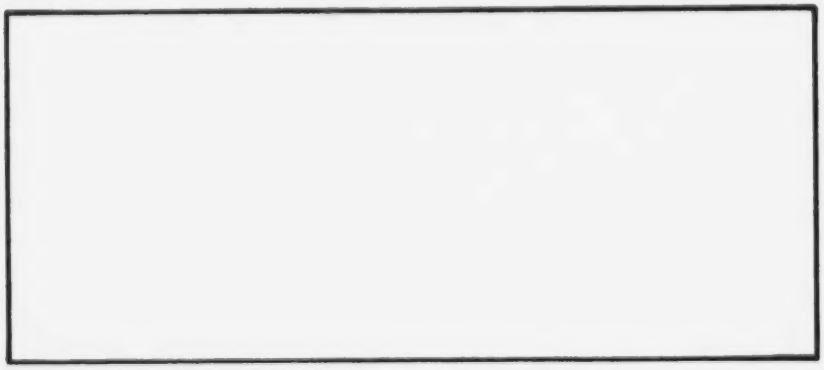
III-3-1
Level 3
LA/SS
P.2 of 2



1985



1995



2005

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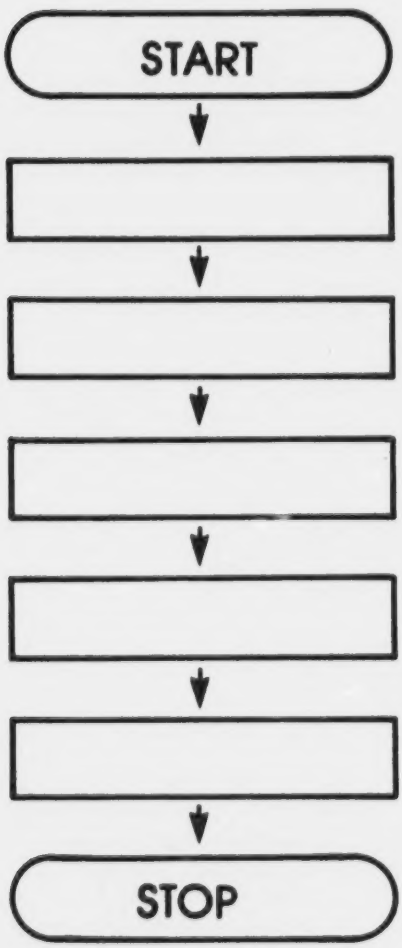
PUTTING THINGS IN ORDER

IV-1-1
Level 1
LA
P.1 of 1

DIRECTIONS:

Here is an example of a simple flow chart. Using this example, draw a flow chart for each of the three activities listed on the right hand side. Be sure to put the lines of flow between the boxes and draw the correct number of boxes. Watch out, the steps are not in order! You may wish to add more steps.



1. Make a flow chart that shows the steps in sharpening your pencil. Include the steps:
   - Remove pencil
   - Insert wooden end of pencil into sharpener
   - Turn handle clockwise

2. Make a flow chart that shows the steps in making toast in a toaster. Include the steps:
   - Adjust darkness control
   - Remove toast when it pops up
   - Get two slices of bread
   - Depress toaster lever
   - Put bread in toaster

3. Make a flow chart that shows the steps in making a hot dog. Include the steps:
   - Get mustard
   - Put wiener in bun
   - Spread mustard
   - Get bun
   - Get hot wiener

149

SOCKS AND SHOES

IV-1-2
Level 2
LA
P.1 of 2

DIRECTIONS:

Carefully cut out the shapes below. Arrange them on a blank piece of paper according to what you know about flow charting. Glue them down. Complete the flow chart by putting in flow lines. Remember to "loop back" from the decision diamond. Include any necessary YES or NO.

STOP

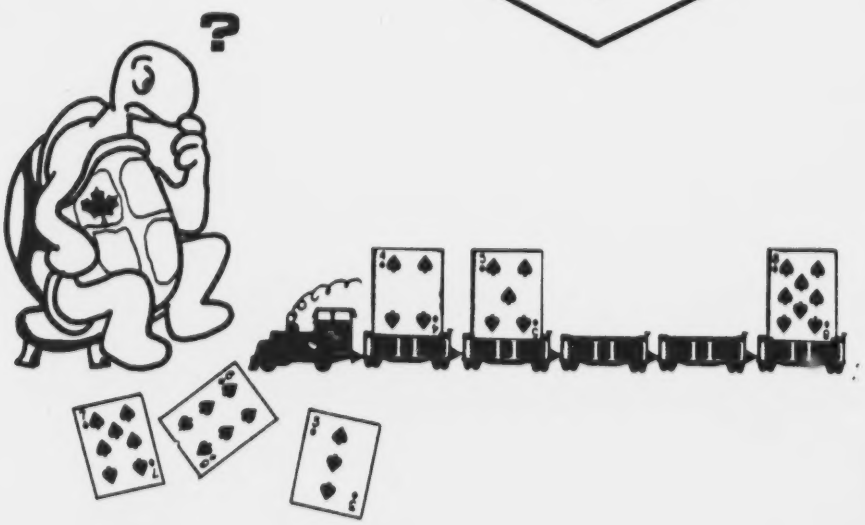
CHOOSE SOCKS

START

PUT ON SOCKS

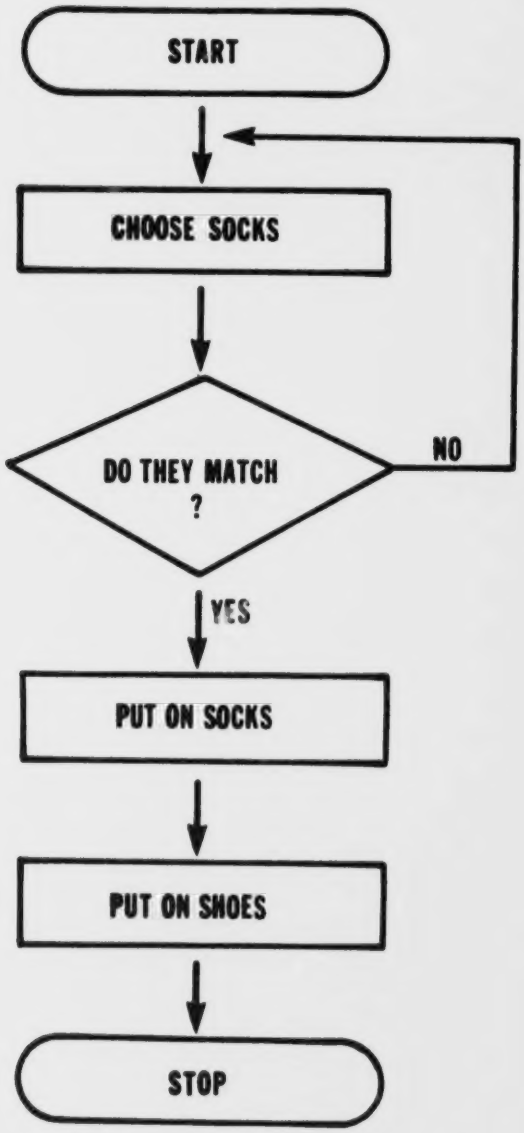
PUT ON SHOES

DO THEY MATCH ?



150

SOLUTION TO "SOCKS AND SHOES"



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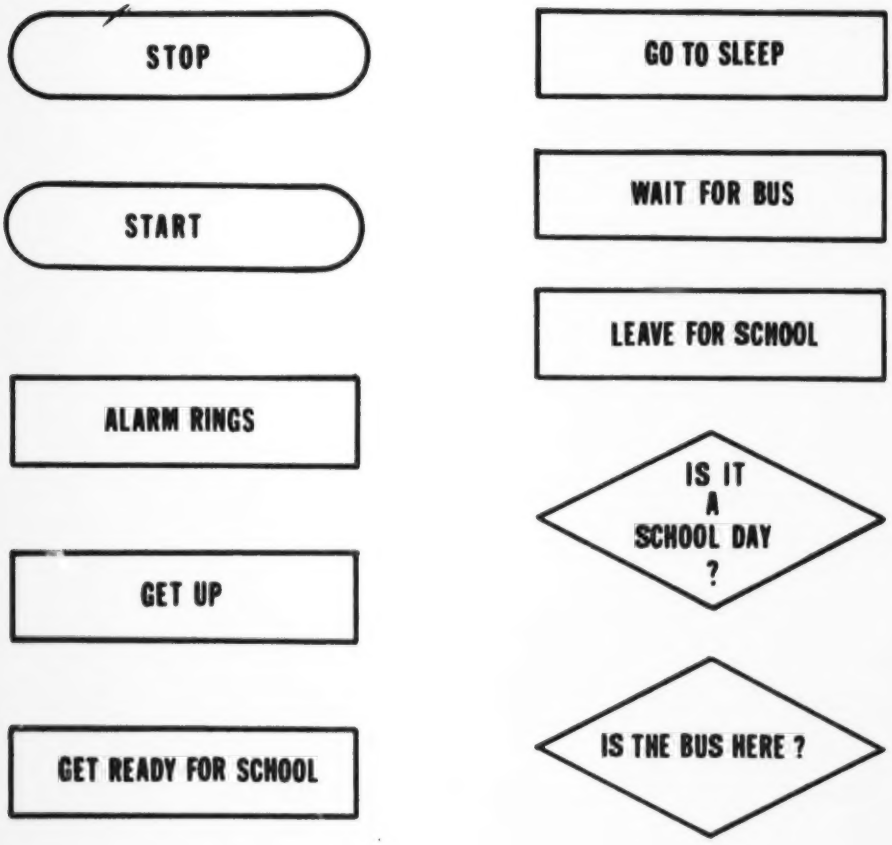
GETTING READY

IV-1-3
Level 3
LA
P.1 of 2

DIRECTIONS:

Here are some pieces to make a flow chart about getting ready for school. Cut out the pieces carefully, arrange them in the right order on a blank sheet of paper, and glue them on. Draw in the flow lines. Remember to "loop back" from the decision diamond. Include any necessary YES or NO.



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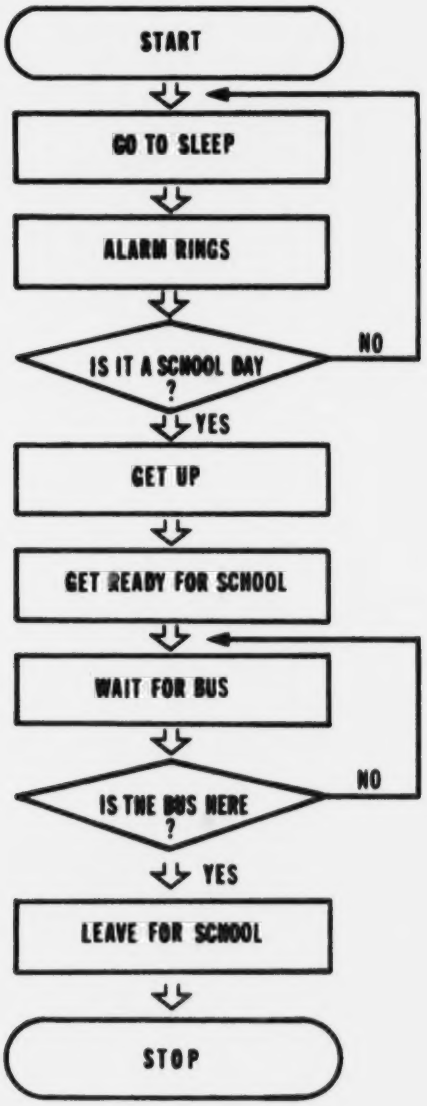
SOLUTION TO "GETTING READY"

IV-1-3
Level 3
LA
P.2 of 2



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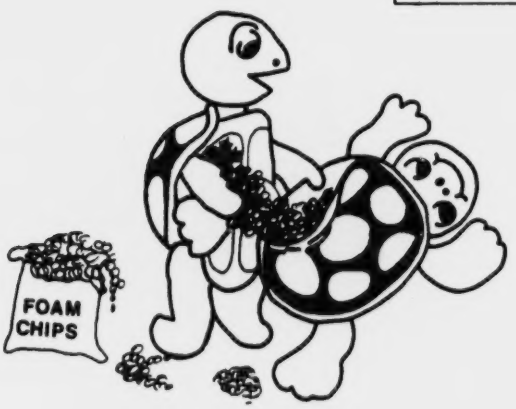
STUFFY TURTLES

IV-4-1
Level 1
Art/Lo/TU
P.1 of 2



MATERIALS:

Each student requires:

- scissors
- 2 large pieces of heavy paper (60 cm x 90 cm)
- coloured tissue paper
- stuffing for turtle (newspaper or styrofoam chips)
- glue mixture (1 part white glue to 1 part water)
- old paint brush

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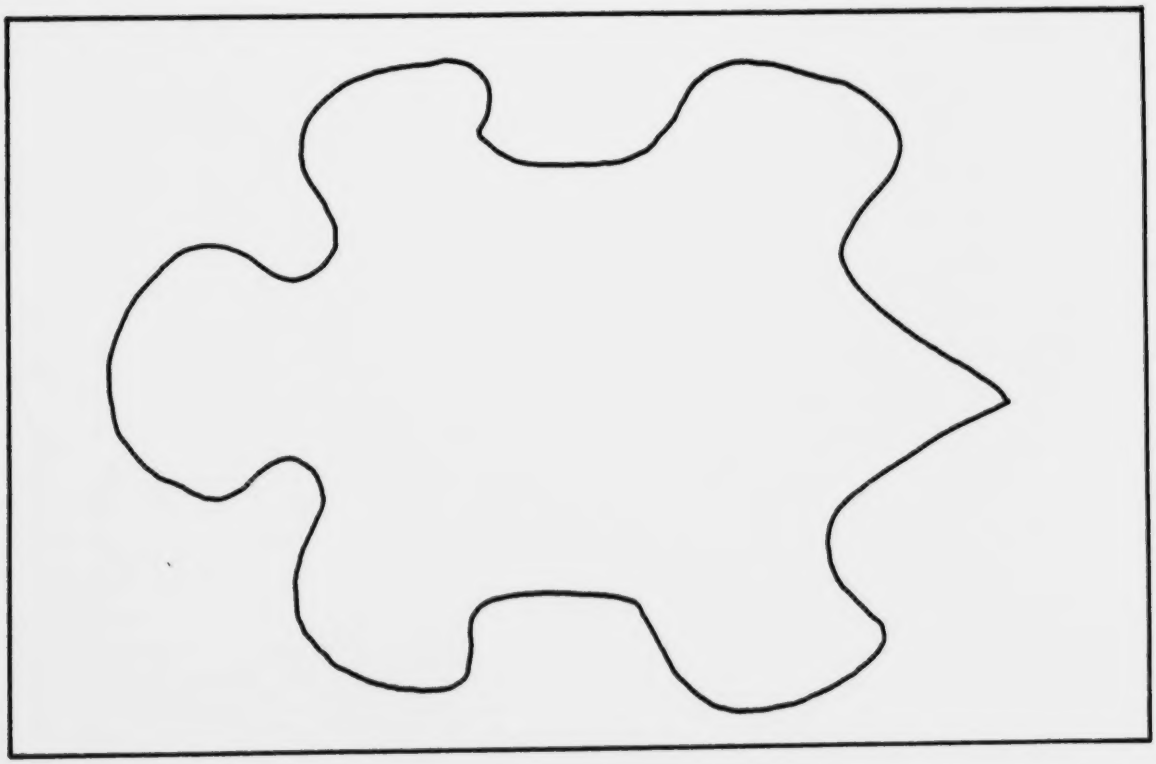
DIRECTIONS:

1. Staple the 2 large pieces of paper one on top of the other.
2. Each student draws a large turtle shape, as seen from above, on the paper.
3. Cut out the turtle shape, labelling one as the top and the other as the bottom.
4. Tear up the coloured tissue paper.
5. Using the paint brush, apply a coat of glue to the top of the turtle.
6. Place the torn tissue paper on the top shape, overlapping the pieces to produce colour and texture.
7. After it dries, brush on a second coat of glue. Allow to dry thoroughly.
8. Decorate the bottom side of the turtle.
9. Leaving an opening, staple the top and bottom of the turtle together.

10. Stuff the turtle with shredded newspaper or styrofoam chips.

11. Staple the opening.



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CLOTH TURTLE

IV-4-2
Level 2
Art/Lo/TU
P.1 of 2

MATERIALS

Each student requires:

- turtle pattern
- 2 pieces of material approximately 20 cm x 27 cm, may be in contrasting colours
- scraps to decorate top shell
- straight pins
- sharp scissors
- needle and thread
- 2 buttons
- material for stuffing - rice, split peas, styrofoam beads, foam rubber pieces
- crochet cotton

DIRECTIONS:

1. Place the two pieces of material right/good sides facing together. Using the straight pins, pin the pattern on through both layers of material.
2. Cut through both layers of material following the pattern.
3. Remove the straight pins and the pattern. If desired, decorate the top shell with material scraps. Stitch R on the turtle's right leg and L on the turtle's left leg.
4. Pin the two pieces of material together with right/good sides facing together.
5. Using a needle and thread, stitch around the turtle 1/2 cm from the cut edge. Do not stitch along one side as shown on the pattern. Leave this as an opening for stuffing. Encourage small stitches or stitching around 3 times to prevent the stuffing from falling out.
6. "Clip" the curved edges for a smoother finish.
7. Turn the turtle right side out.
8. Sew on the buttons for eyes.
9. Stuff the turtle.
10. To close the opening, turn the seam inside and sew closed using small overcast stitches.

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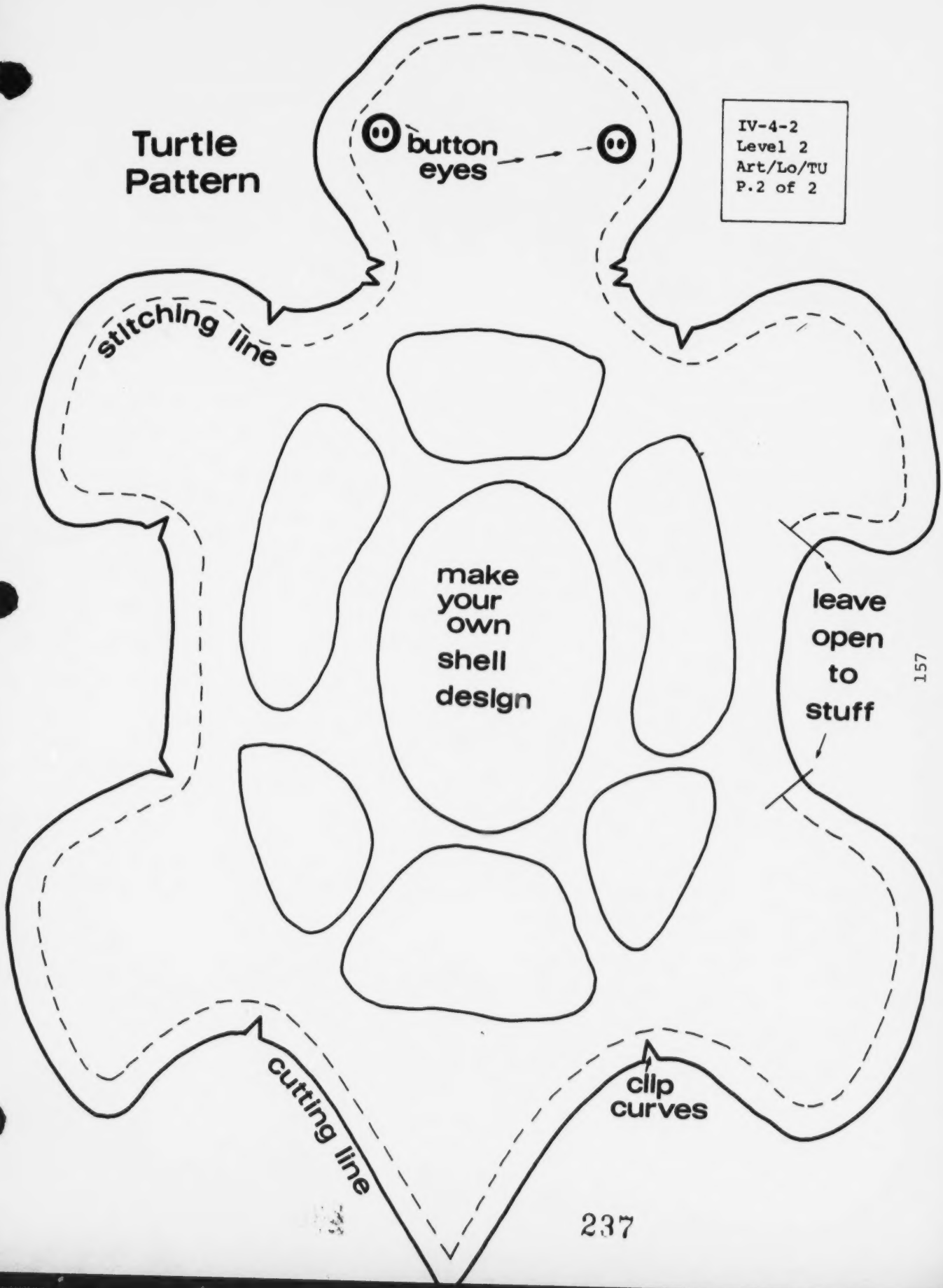
Turtle Pattern



IV-4-2
Level 2
Art/Lo/TU
P.2 of 2

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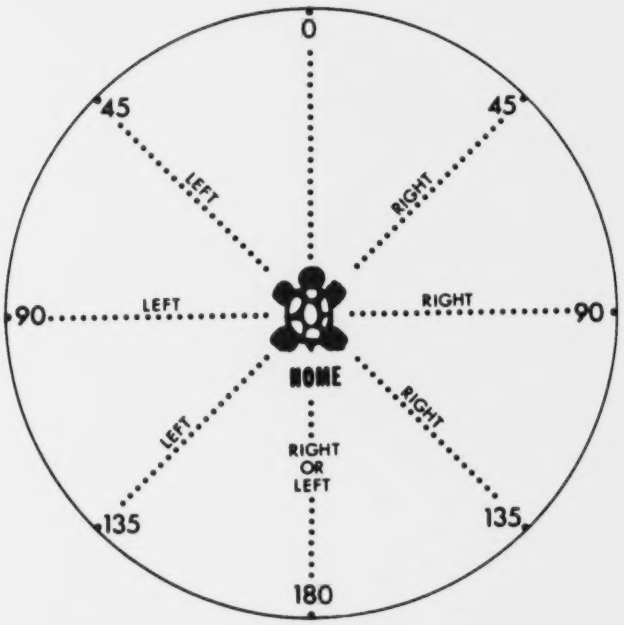
Turtle Turning Wheel

IV-6-1
Levels 1,2,3
Lo
P.1 of 1

DIRECTIONS:

1. Reproduce the Turtle Turning Wheel on a piece of clear acetate.
2. Cut out the Turtle Turning Wheel.
3. Position the Turtle Turning Wheel over the "screen turtle" so that both turtles are facing in the same direction.
4. Use the numbers on the Turtle Turning Wheel to estimate the amount the screen turtle must be turned to face in the desired direction.
5. Keep your Turtle Turning Wheel in your Logo Log Book.



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IV-6-2
Levels 1,2,3
Lo/TU
P.1 of 2

LEARNING WITH LOGO

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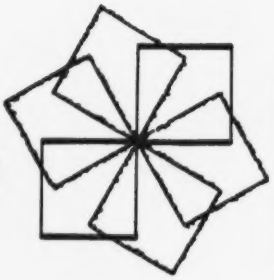
Name.....

TABLE OF PROCEDURES



IV-6-2
Levels 1,2,3
Lo/TU
P.2 of 2

Name of Procedure:	Description:

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IV-6-3
Level 1
Lo/H-o
P.1 of 2

TURTLE'S FIRST STEP

DIRECTIONS:

Use the following Logo or Logo-like commands to help the "screen turtle" take its first steps.

Logo Commands:

FD	FORWARD
BK	BACK
RT	RIGHT
LT	LEFT
HOME	"Homes" Turtle
CS	Clears Screen

Logo-like Commands:

DF	Draw Forward
TR	Turn Right
TL	Turn Left
AR	Angle Right
AL	Angle Left
HOME	"Homes" Turtle
CLEAR	Clears Screen

1. Take the turtle forward, back, left, and right using very large numbers.
2. Take the turtle forward, back, left, and right using very small numbers.
3. Record the LARGEST AND SMALLEST distance the turtle can travel.

   LARGEST: _____

   SMALLEST: _____

4. Now type HOME. What happened? _____

   _____

5. Now clear the screen. What command did you use? _____

   _____

6. How many turtle steps is it from the turtle's HOME position to the TOP of the screen?

   _____ TURTLE STEPS

7. How many turtle steps is it from the HOME position to the side of the screen?

   _____ TURTLE STEPS

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8. How many turtle steps is it from the HOME position to the bottom of the screen?

_____ TURTLE STEPS

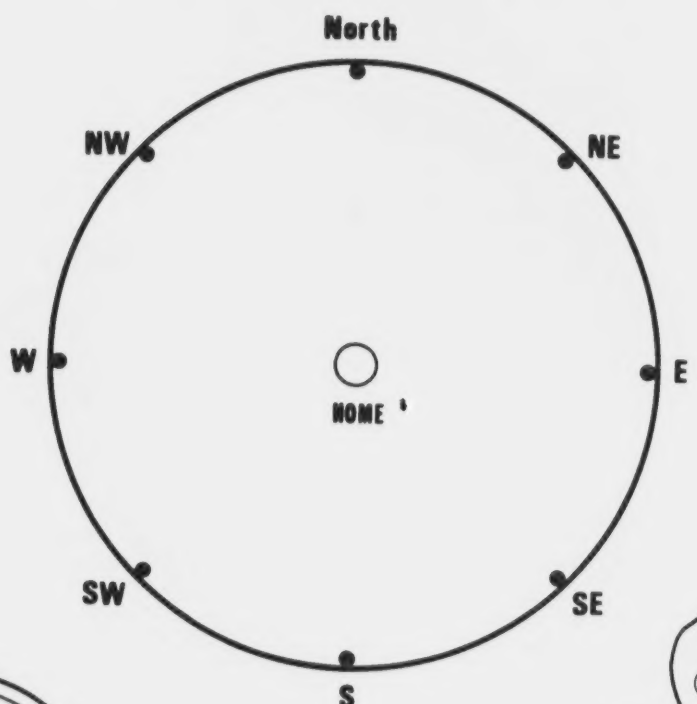
9. Keep this worksheet in your Logo Log Book.

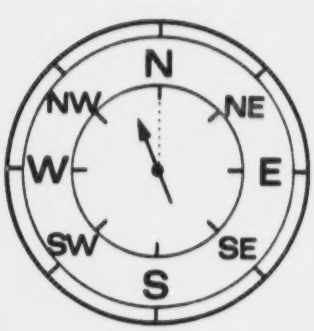
TURTLE'S COMPASS

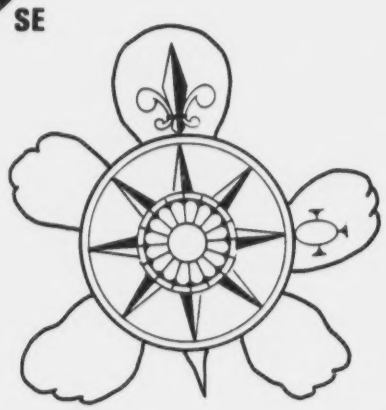
IV-6-4
Level 1
SS/Lo/H-o
P.1 of 3

DIRECTIONS:

1. Reproduce the illustration below on a transparency.
2. Tape the transparency to the edge of the monitor so that the turtle is at the centre of the compass (HOME position).
3. Have each pair of students complete the activities on the next page.







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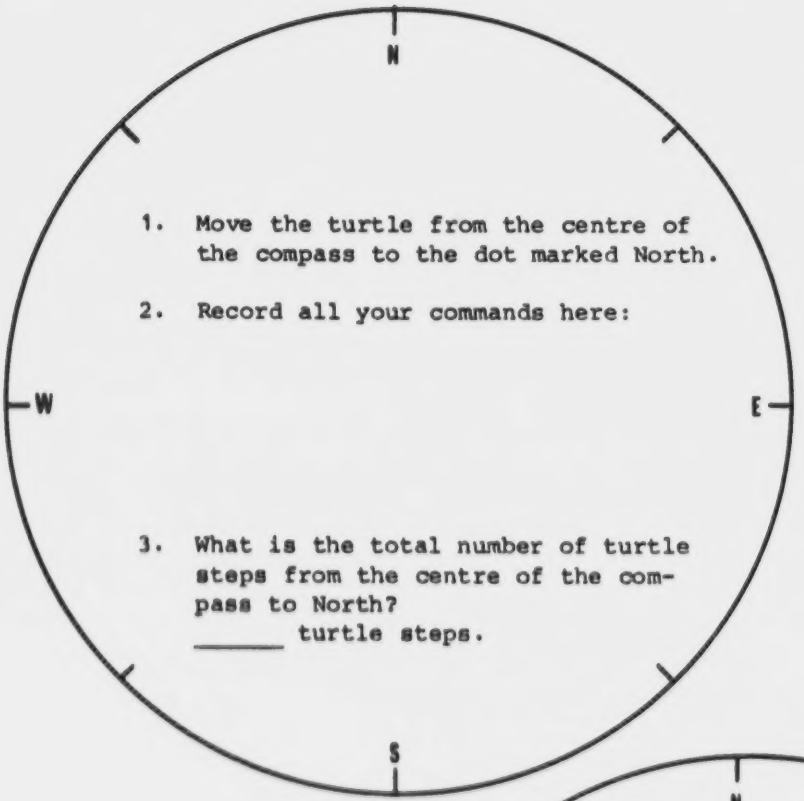
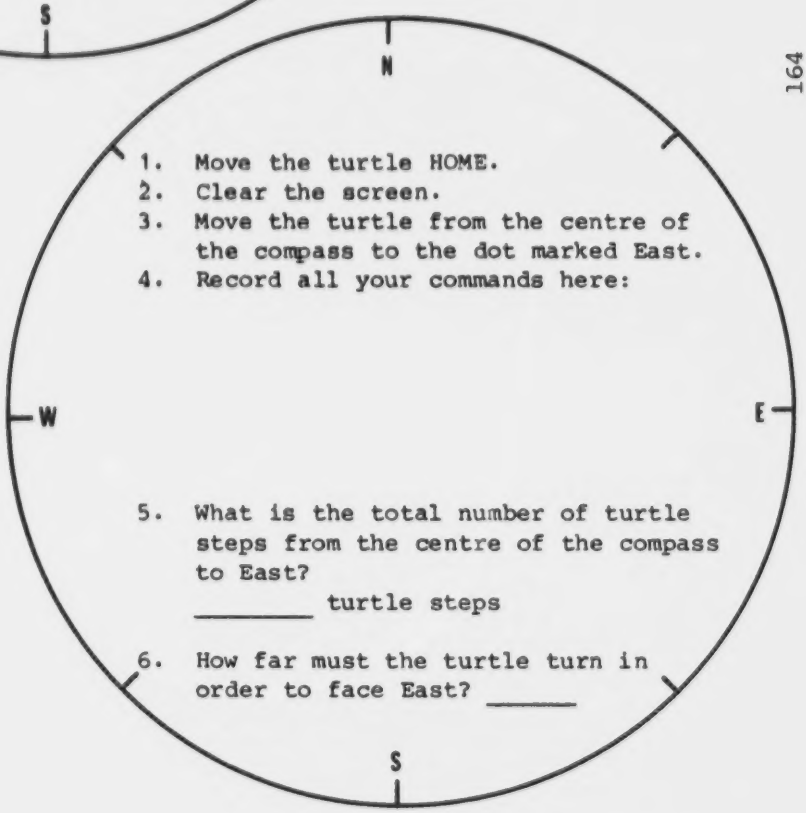


1. Move the turtle from the centre of the compass to the dot marked North.
2. Record all your commands here:

3. What is the total number of turtle steps from the centre of the compass to North?
_____ turtle steps.



1. Move the turtle HOME.
2. Clear the screen.
3. Move the turtle from the centre of the compass to the dot marked East.
4. Record all your commands here:

5. What is the total number of turtle steps from the centre of the compass to East?
_____ turtle steps

6. How far must the turtle turn in order to face East? _____

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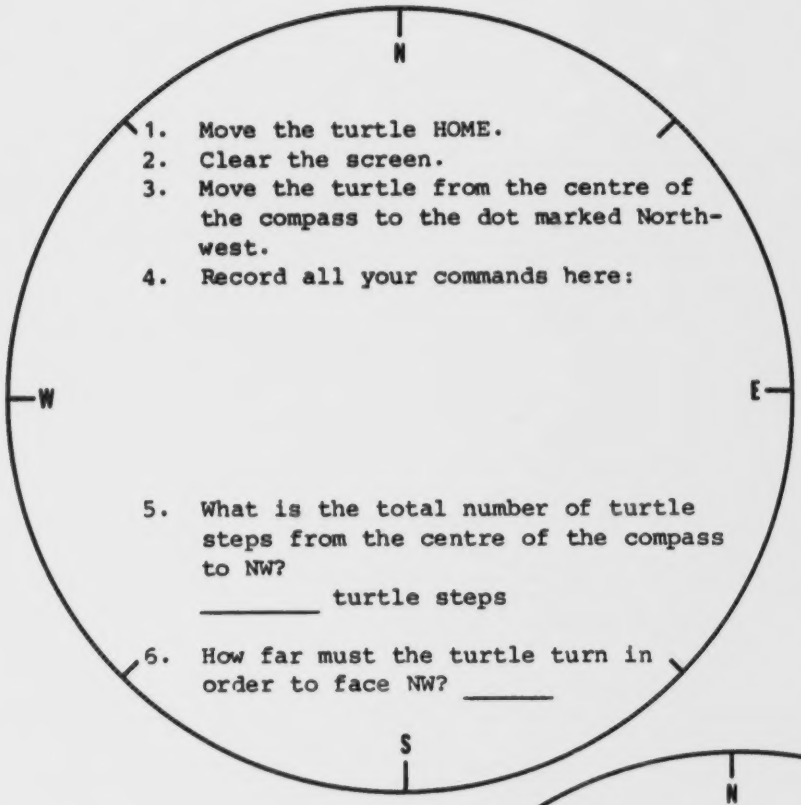
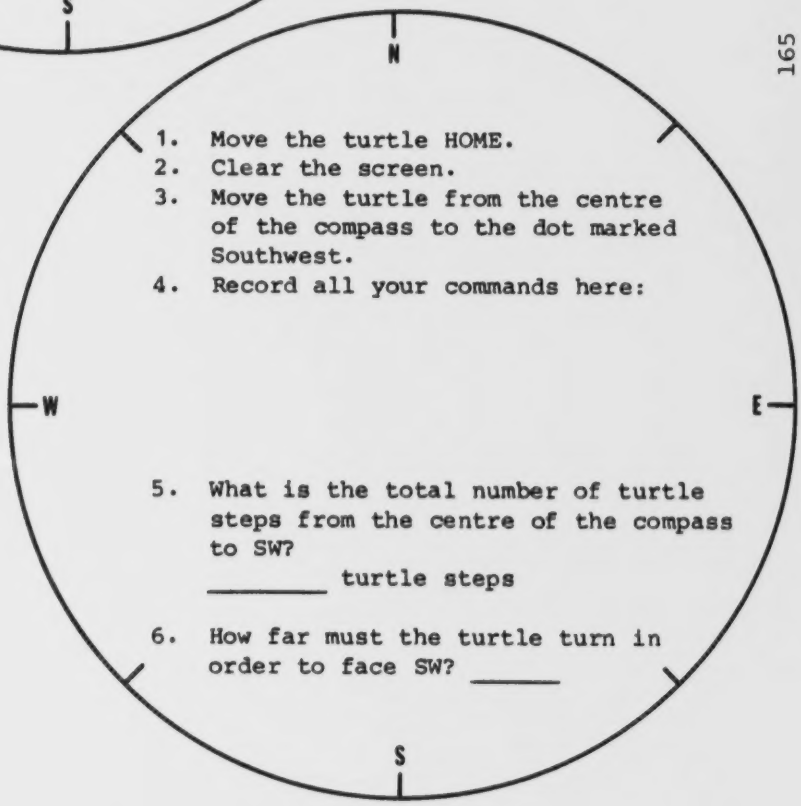


1. Move the turtle HOME.
2. Clear the screen.
3. Move the turtle from the centre of the compass to the dot marked Northwest.
4. Record all your commands here:

5. What is the total number of turtle steps from the centre of the compass to NW?
_____ turtle steps

6. How far must the turtle turn in order to face NW? _____



1. Move the turtle HOME.
2. Clear the screen.
3. Move the turtle from the centre of the compass to the dot marked Southwest.
4. Record all your commands here:

5. What is the total number of turtle steps from the centre of the compass to SW?
_____ turtle steps

6. How far must the turtle turn in order to face SW? _____

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TURTLE TRAVELS

IV-6-5
Level 1
Lo/H-o
P.1 of 2

DIRECTIONS:

Use the "screen turtle" in immediate mode and the commands listed below to complete this assignment.

Logo Commands:

PU PENUP
PD PENDOWN

Logo-like Commands:

JF JUMP FORWARD

1. Using the new commands from "Turtle Travels" and the commands from "Turtle's First Steps" draw a shape on the screen. Give the turtle at least ten commands to draw your shape. Record the commands in the space below and draw the shape in the box.

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2. Your turtle is working on the Turtle Land highway construction team. The turtle's job is to paint the dashed centre line on the highway. The highway centre line should go from one side of the screen to the

other. To start the job, take your turtle to one side of the screen without leaving a trail. Start painting! Record all of the commands in the space below and draw the highway centre line in the box.

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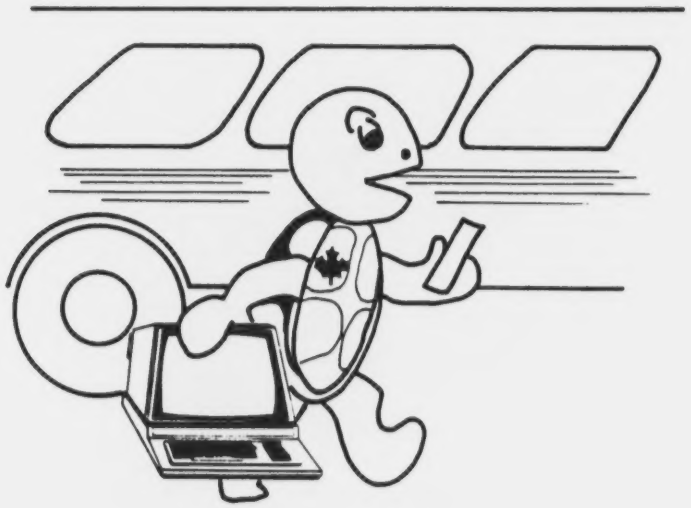
Put this worksheet in your Logo Log Book.

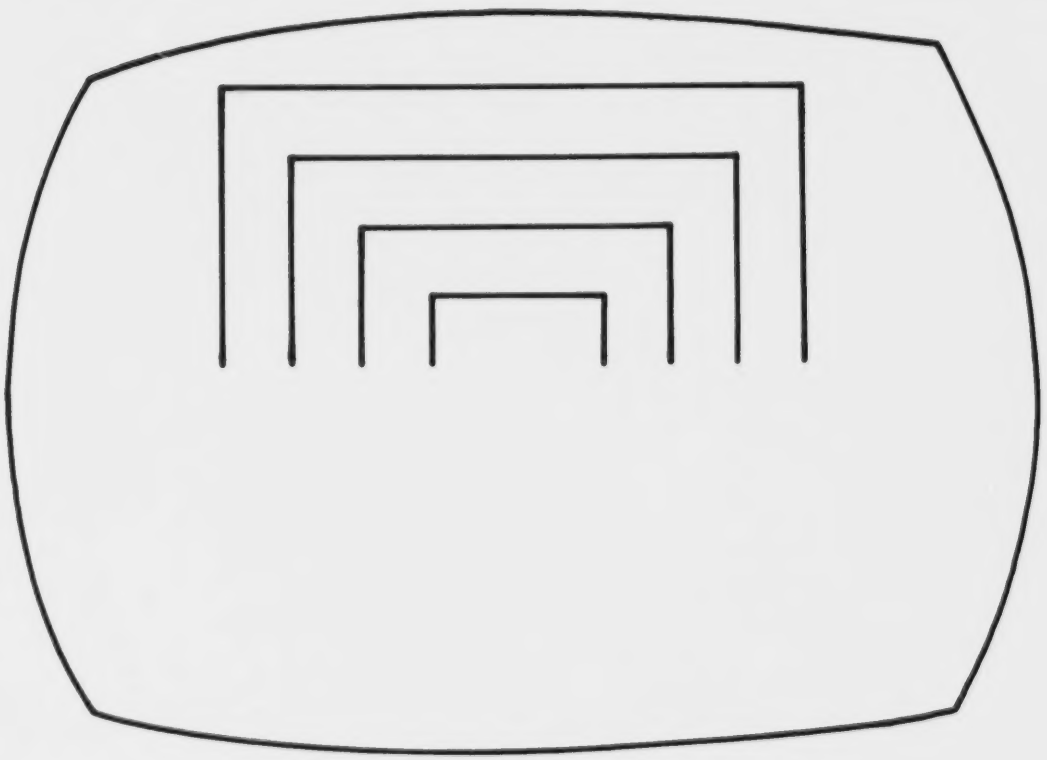


RAINBOW TURTLE*

IV-6-6
Level 1
Lo/H-o
P.1 of 2

DIRECTIONS:

1. Choose a partner for this activity.
2. Use the Pen Colour command and the other Logo commands you have learned to draw a rainbow similar to the drawing shown below.
3. Make each of the six bands of the rainbow a different colour.
   HINT: You can change the turtle's ink by typing PC followed by a space and then a number 0, 1, 2, 3, 4, or 5. Example: PC 2.
4. Alternate partners and change the colour of the pen before drawing each band.



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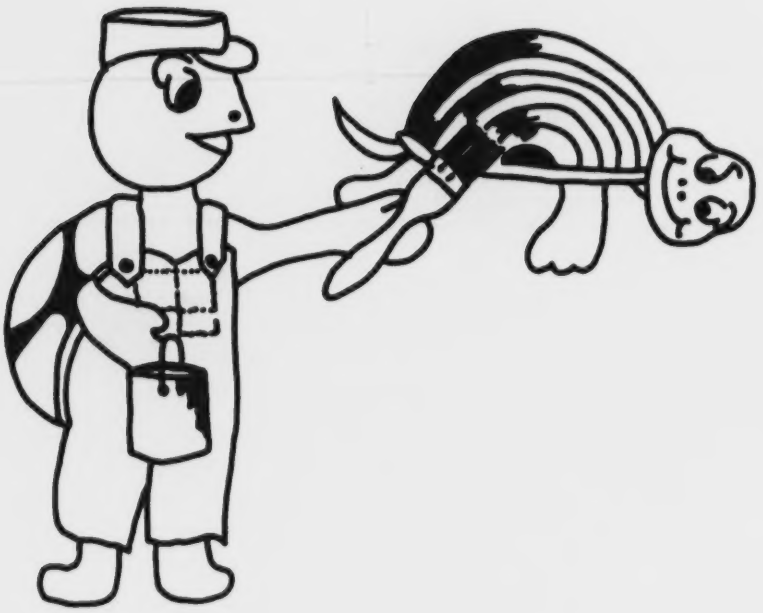
* Requires a commercial version of Logo and a colour monitor.



Name the colours of the bands produced by each command.

Command	Pen Colour
PC 0	_____
PC 1	_____
PC 2	_____
PC 3	_____
PC 4	_____
PC 5	_____

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Extensions: If time permits, students could create their own drawings using different pen colours to enhance the pictures.

In future activities, students should be encouraged to use different pen colours.

Place these pages in your Logo Log Book.

Sherlock Turtle

IV-6-7
Level 2
Lo/H-o
P.1 of 3

DIRECTIONS:

Use the commands below to complete the following activities. Be sure to record your answers in the spaces provided and to place these pages in your Logo Log Book.

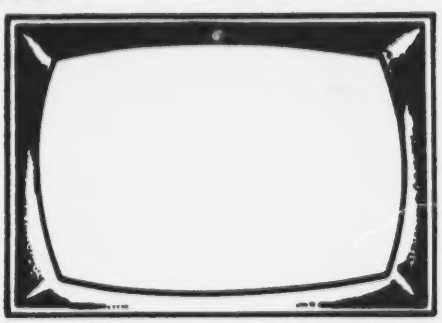
Logo Commands:

HT Hides the turtle
ST Shows the turtle

1. Type in the commands.

```
FD 40
PU
FD 20
```

Draw a picture of what you see on the screen.



What letter of the alphabet has the turtle drawn? _____

What part of the letter does the turtle make? _____

2. Change the letter of the alphabet to the number 1. Which command did you use? _____

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3. Change the number 1 back into the letter. Which command did you use?

_____

4. PARTNER ACTIVITY

- You need a partner to do this one! Choose one partner to be the "detective" and the other to be the "magician". The "detective" should record in the "Detective's Notebook" the commands that the "magician" gives to the turtle. The "Detective's Notebook" is found on page 3 of this activity.

- The "magician" should HIDE the turtle, then put the turtle's PEN UP and move the invisible turtle to a secret location using 5 commands. The "detective" then uses the instructions from the "Detective's Notebook" to solve the mystery of the disappearing turtle. To see if the "detective" has solved the mystery, the "magician" should SHOW the turtle. After the mystery is solved, the "detective" and the "magician" change places.

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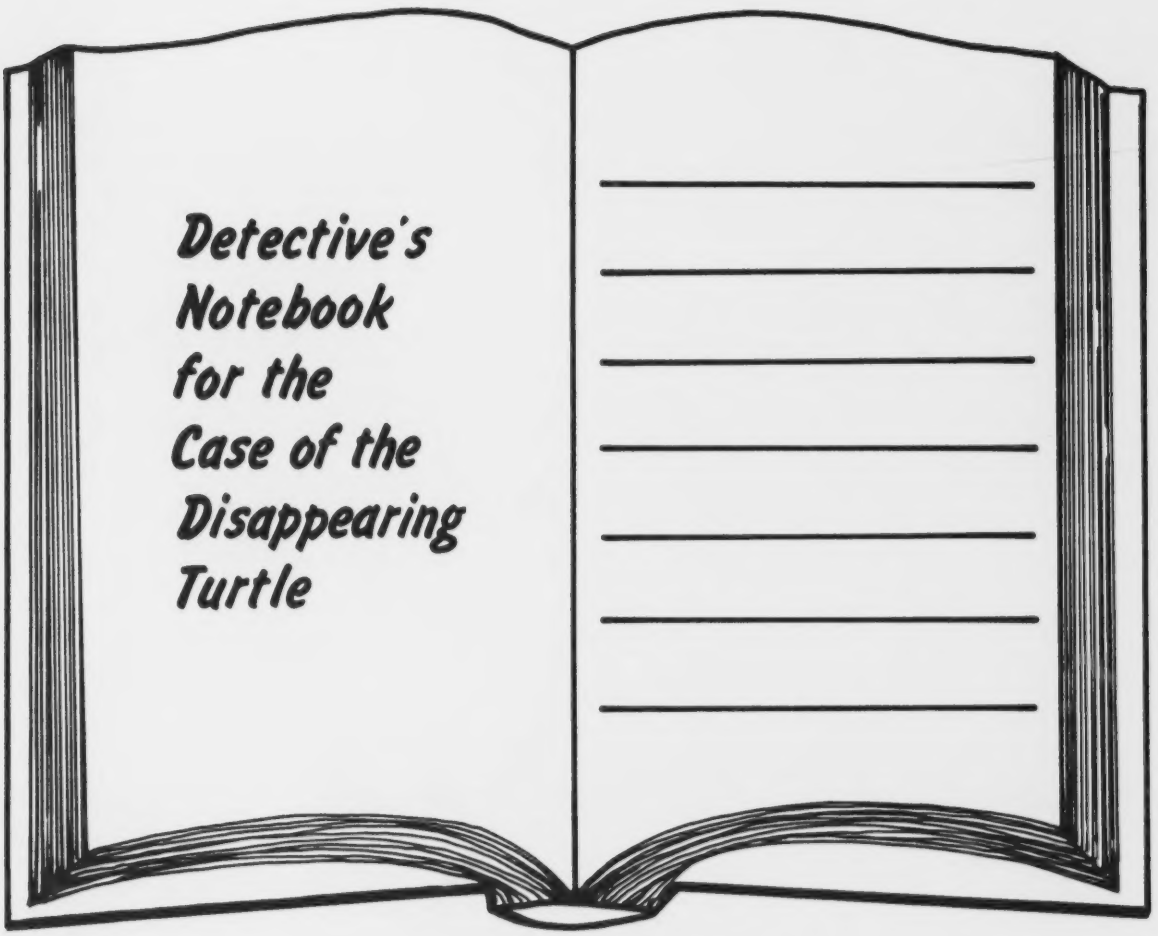

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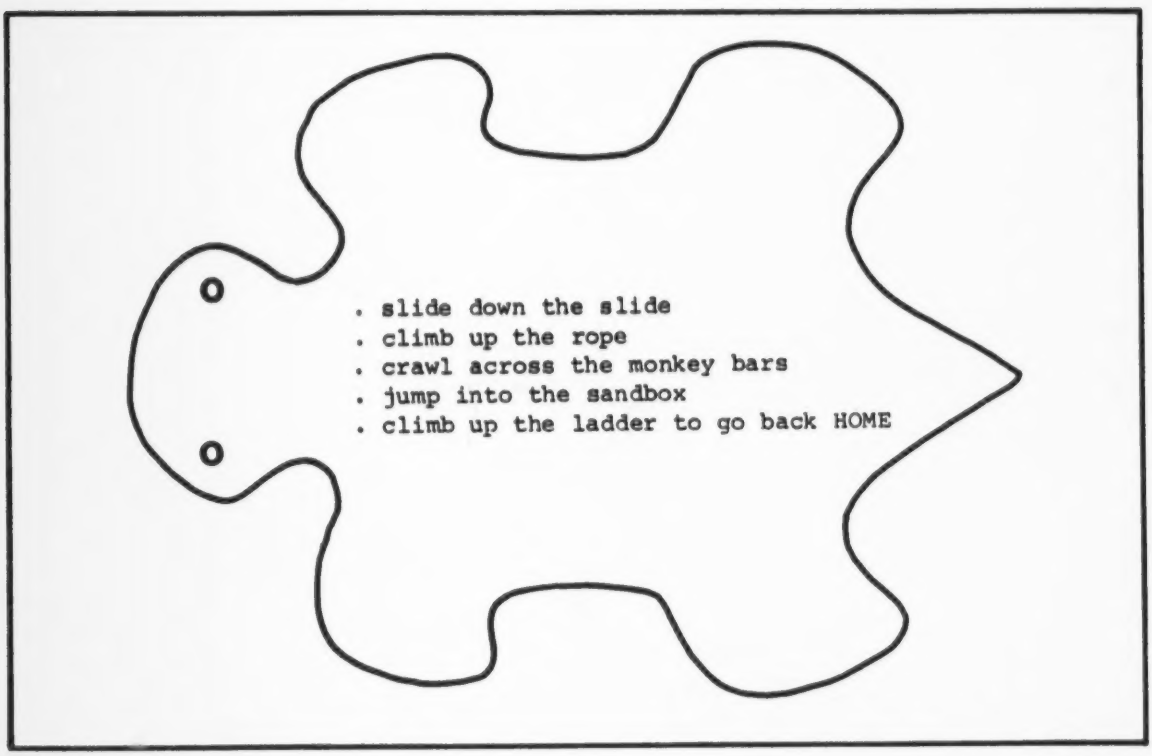
Put this into your Logo Log Book.

TRANSPARENT TURTLE

IV-6-8
Level 3
Lo/TU
P.1 of 2

DIRECTIONS:

1. Reproduce the illustration from the next page as a transparency.
2. Tape the transparency to the edge of the monitor so that the turtle is in the "HOME" position.
3. Challenge each pair of students to take the turtle around the obstacle course following the directions on the card below.
4. Leave the transparency and direction card by the computer for further student exploration.


. slide down the slide
. climb up the rope
. crawl across the monkey bars
. jump into the sandbox
. climb up the ladder to go back HOME

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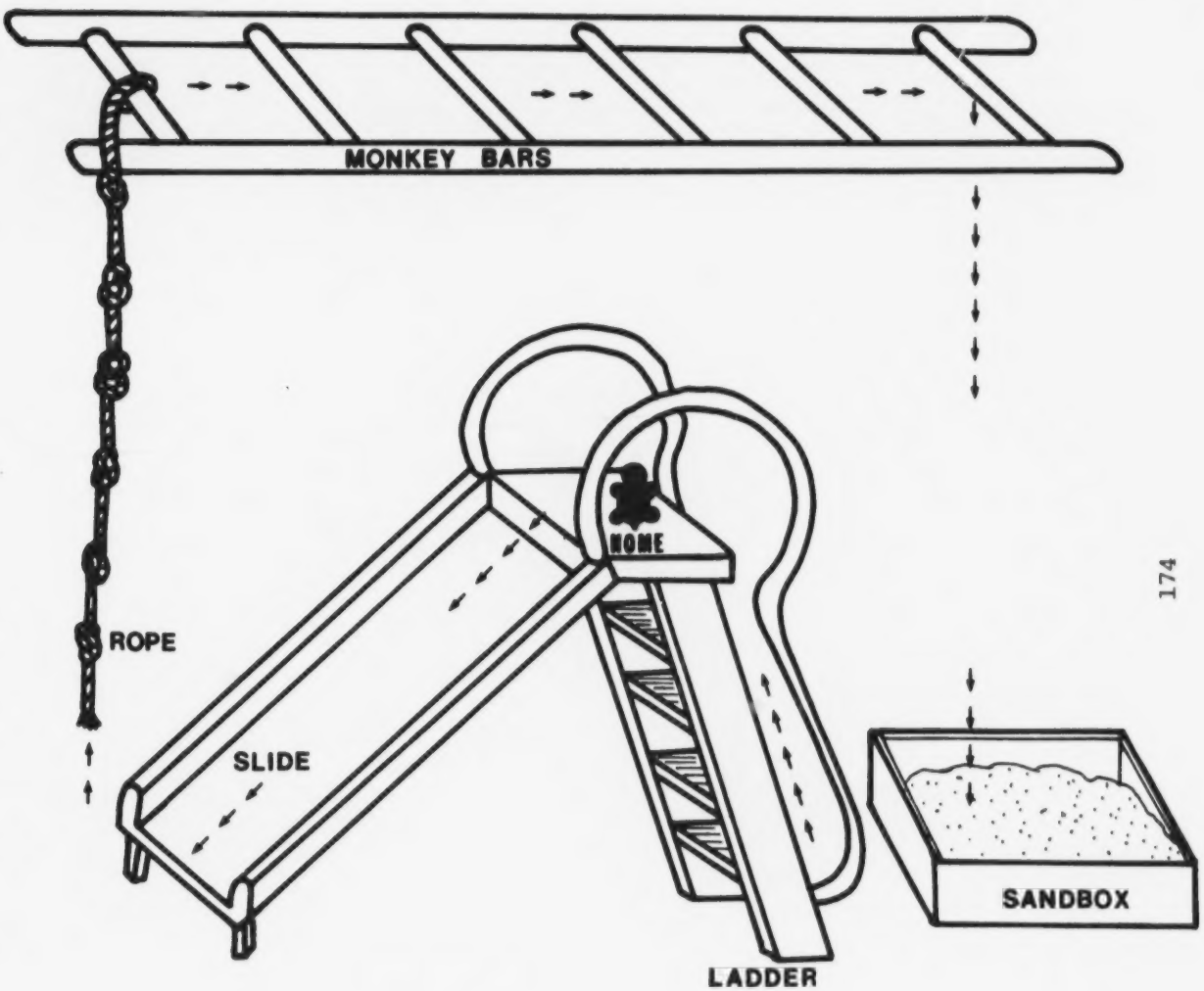

Extensions: Have students create their own obstacle course or maze on a transparency. Students should invent the rules or directions for their activity and challenge other students to complete it.

TURTLE ADVENTURE GAME

IV-6-9
Level 3
Lo/H-o/TU
P.1 of 2

DIRECTIONS:

1. Reproduce the activity card.
2. Reproduce the illustration on the next page as a transparency.
3. Tape the transparency to the edge of the monitor.
4. Challenge each pair of students to satisfy the hungry Overlord following the directions on the activity card.
5. Leave the transparency and activity card by the computer for further student exploration.

ACTIVITY CARD

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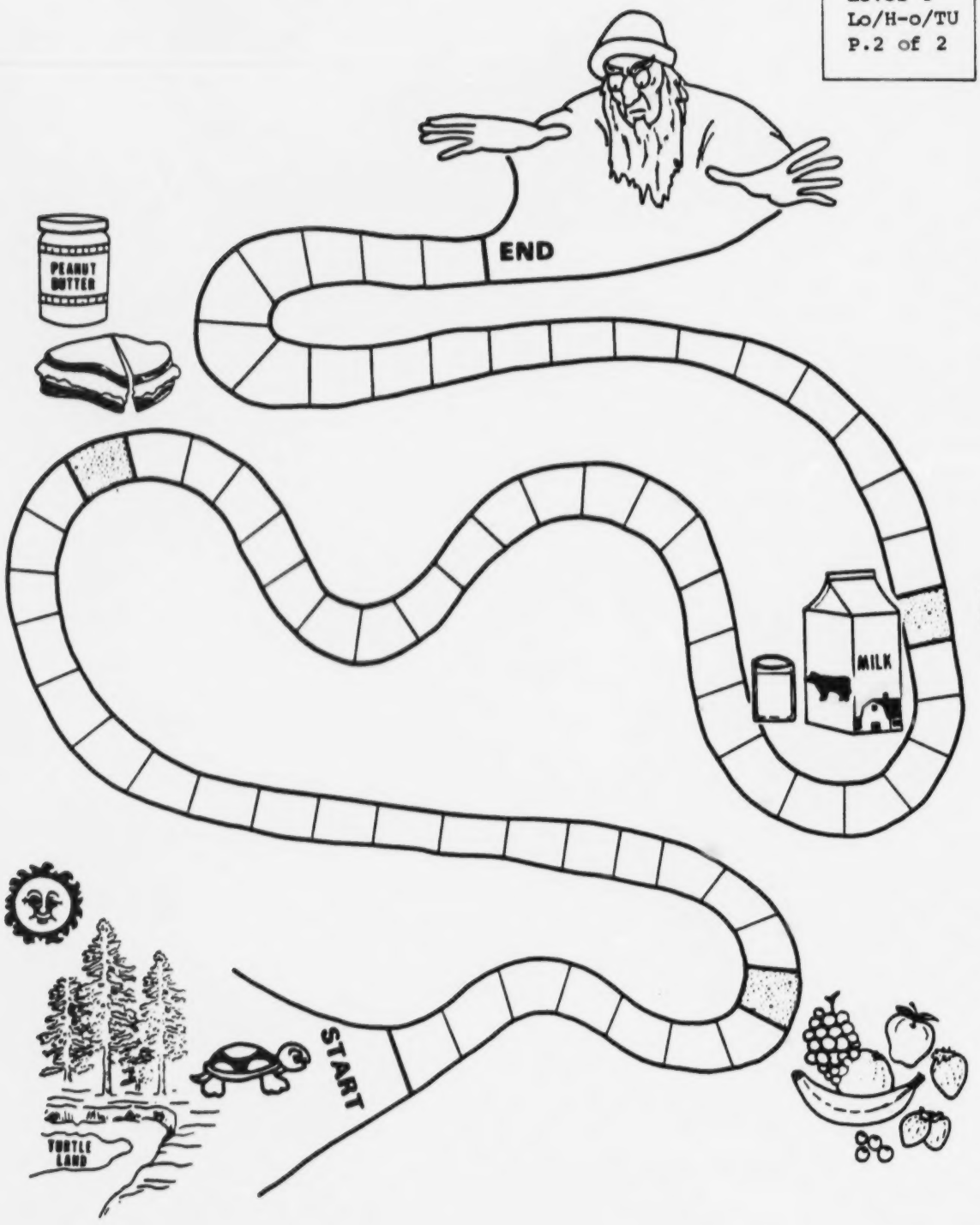
Turtleland is in danger of being destroyed by the ferociously hungry Overlord. The Overlord is especially mean because he has been on a diet for a week.

To save Turtleland from destruction, you must gather and take food found along the path to the Overlord.

Move the turtle to the start. Following the path toward the mean Overlord, land on each of the foods along the way. After you have landed on each of the foods in order, complete the path to the Overlord.

When you land on the Overlord, his hunger is satisfied and you have saved Turtleland!

IV-6-9
Level 3
Lo/H-o/TU
P.2 of 2



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Pencil Turtle

IV-7-1
Levels 1,2,3
Lo
P.1 of 1

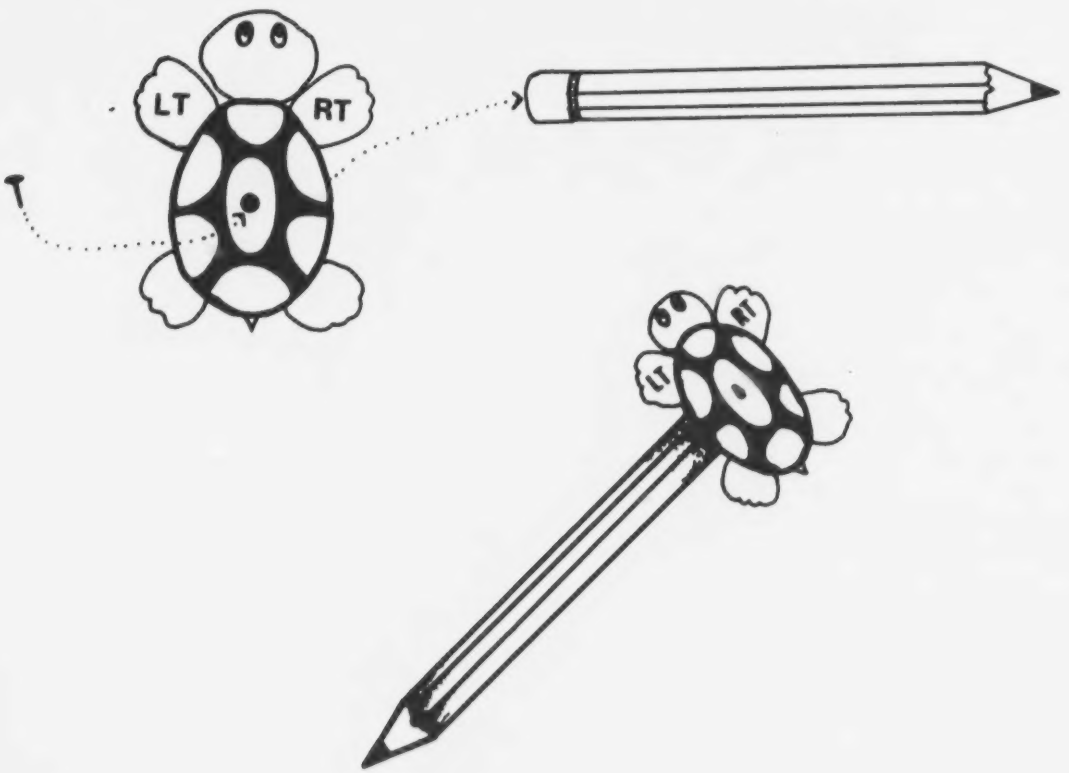
DIRECTIONS:

1. Each student should draw and decorate their own "pencil" turtle (approximately 5 cm x 5 cm) using heavy paper such as manilla tag.

2. Students should label the right and left front legs RT and LT to assist in determining the turning direction.

3. The "pencil" turtle can be fastened to the student's pencil using a straight pin pushed into the eraser end.

4. The "pencil" turtle should be held perpendicular to the paper as the student redraws their sketch step-by-step.



177

IV-7-2
Level 1
Lo/H-o
P.1 of 2

TURTLES on SAFARI

DIRECTIONS:

Your turtle has been on safari all day in the deep dark jungles of Africa and is ready to set up camp for the night. Help your turtle put up a tent.

1. Draw a picture of the turtle's tent on the screen diagram on the next page.
2. Plan your procedure using the space titled "Procedure Plan" on the next page. Give your procedure a name.
3. Define your procedure on the computer.
4. Test your procedure to see if it works.
5. Revise your procedure if needed.
6. Save your procedure on diskette.
7. Record your final procedure using the space titled "Final Procedure" on the next page.
8. Put these pages in your Logo Log Book.

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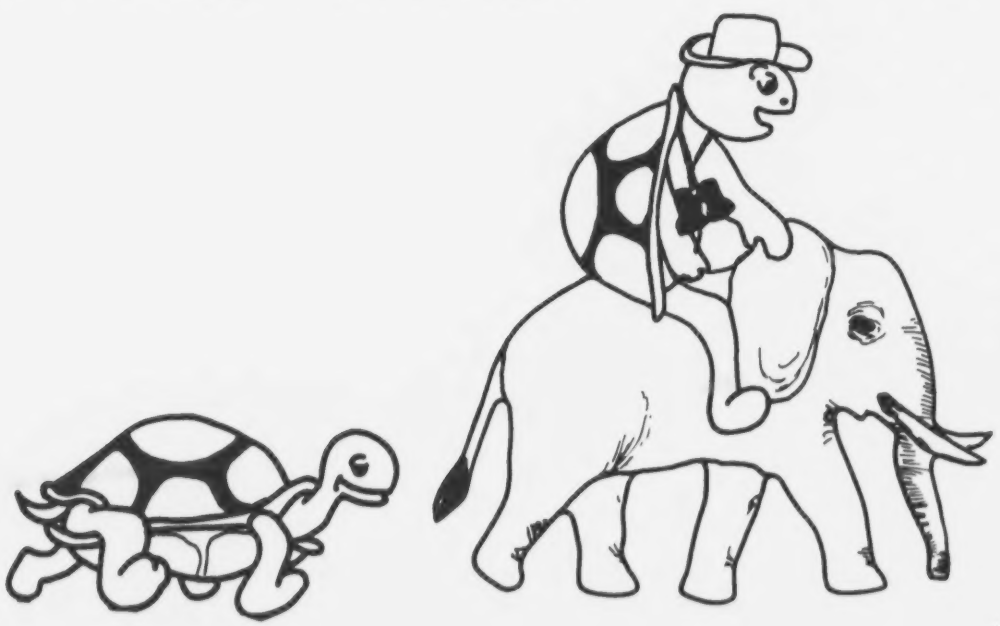

IV-7-2
Level 1
Lo/H-o
P.2 of 2

Procedure Plan

Final Procedure

179

TURTLES AT WORK

IV-7-3
Level 1
Lo/H-o
P.1 of 2

DIRECTIONS:

Your turtle is working hard learning how to print at school. Teach your turtle how to print the first initial of your name.

1. Draw a sketch of your first initial on the screen diagram on the next page.

2. Plan your procedure using the space titled "Procedure Plan" on the next page. Give your procedure a name.

3. Define your procedure on the computer.

4. Test your procedure to see if it works.

5. Revise your procedure if needed.

6. Save your procedure on diskette.

7. Record your final procedure using the space titled "Final Procedure" on the next page.

8. Put these pages in your Logo Log Book.

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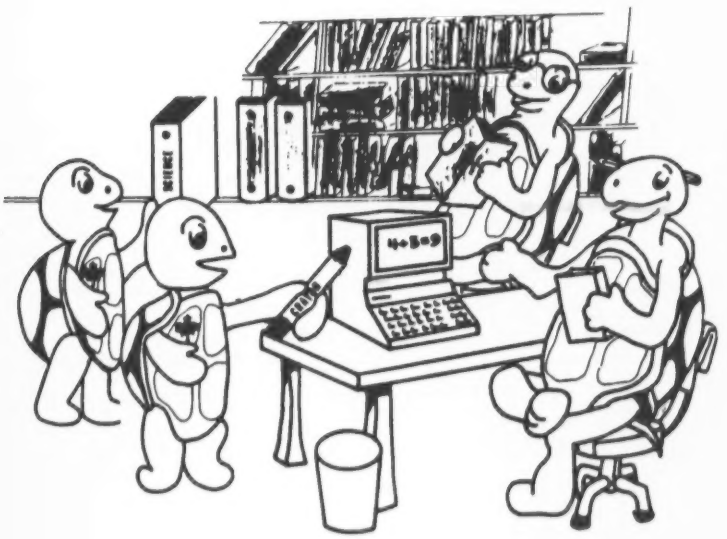
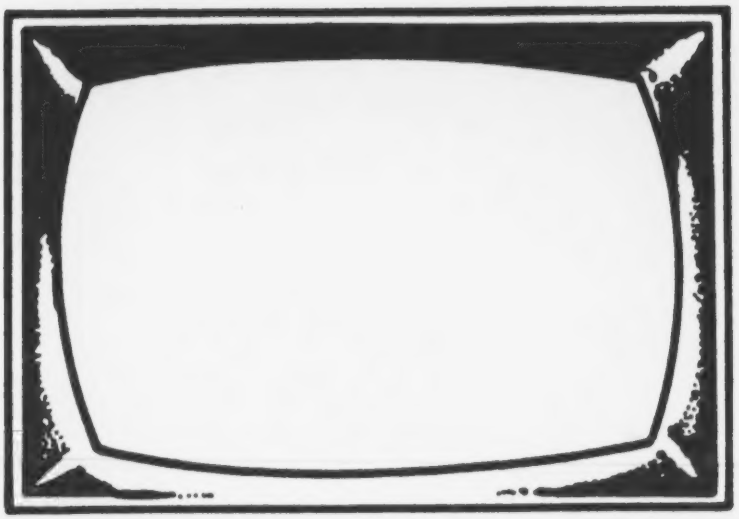


IV-7-3
Level 1
Lo/H-o
P.2 of 2



Procedure Plan

Final Procedure

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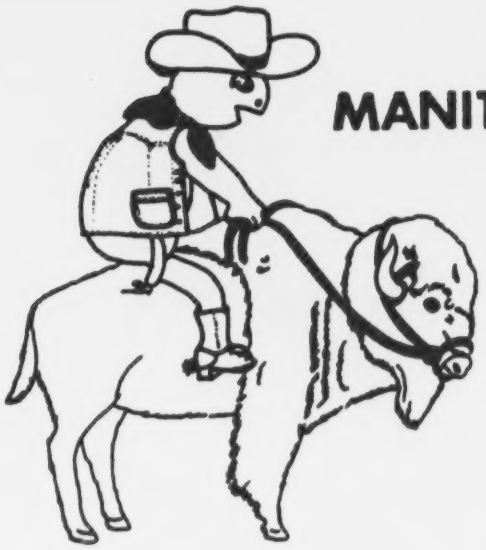

MANITOBA TURTLES

IV-7-4
Level 2
SS/Lo/H-o
P.1 of 2

DIRECTIONS:

It is now the year 1870. The Province of Manitoba has just been created. Your turtle has been assigned the task of surveying the borders of the province. Write a Logo procedure to draw an outline of the map of Manitoba, using colour if possible.

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1. Use the map of Manitoba on the next page as a guide for your turtle's survey.

2. Plan your procedure in the space titled "Procedure Plan" on the next page. Give your procedure a name.

3. Define your procedure on the computer.

4. Test your procedure to see if it works.

5. Revise your procedure if needed.

6. Save your procedure on diskette, as you will need to edit this procedure in the activity "Places in Manitoba."

7. Record your final procedure in the space titled "Final Procedure" on the next page.

8. Put these pages in your Logo Log Book.

IV-7-4
Level 2
SS/Lo/H-o
P.2 of 2

Procedure Plan

Final Procedure

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PLACES IN MANITOBA

IV-7-5
Level 2
SS/Lo/H-o
P.1 of 3

DIRECTIONS:

In the activity "Manitoba Turtles," your turtle drew the borders of the province. Now, your turtle must mark the position of your home and one other population centre. Use an atlas or a road map of Manitoba to locate these places. List them here.

(1) _____ (your home)

(2) _____

You will be writing a Logo procedure to draw a small box to mark each place on your turtle's map of Manitoba.

1. Using the map on page 3 of this activity, mark the places you have chosen in Manitoba.
2. Refer to your Logo Log Book to find the written copy of your "Final Procedure" from the activity "Manitoba Turtles."
3. Make changes to this procedure so that the turtle will draw a small box to show the two places you have chosen. Give your new procedure a new name.
4. Record the edited procedure in the space titled "Procedure Plan" on page 3.
5. Load the procedure that you saved in the activity "Manitoba Turtles," into the computer.
6. Edit your old procedure on the computer. Do not forget to change the old name to the new name.
7. Test your new procedure to see if it works.
8. Revise your procedure if needed.

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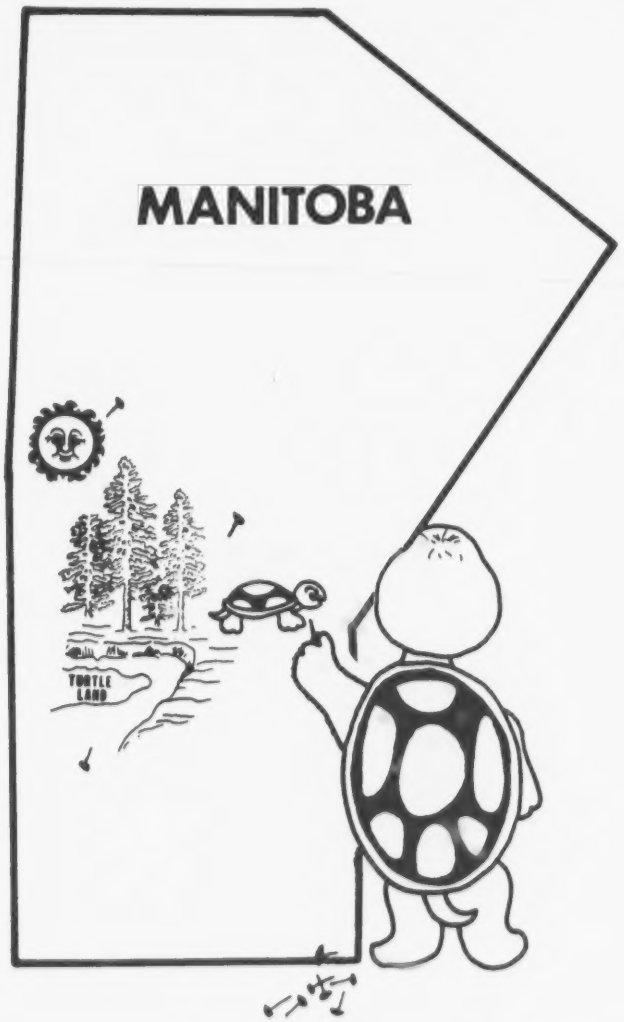
9. Save your new procedure, using its new name, on diskette.

10. Record your final procedure in the space titled "Final Procedure" on page 3.

11. Put these pages in your Logo Log Book.



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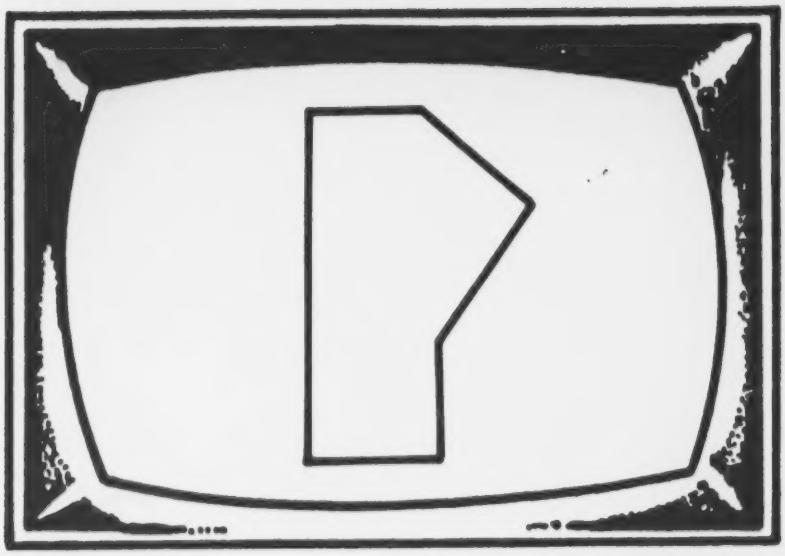
IV-7-5
Level 2
SS/Lo/H-o
P.3 of 3



Procedure Plan

Final Procedure

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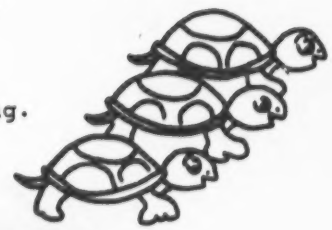
TURTLES, TURTLES, and MORE TURTLES

IV-8-1
Level 1
Lo/H-o
P.1 of 2

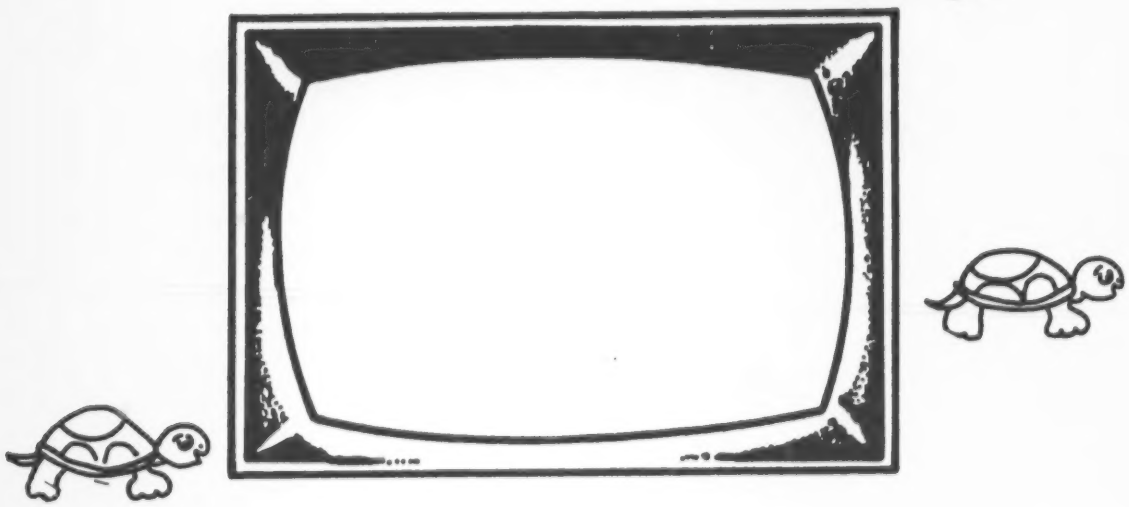
DIRECTIONS:

1. Using Logo in immediate mode, type the following:

   REPEAT 6 [FORWARD 40 LEFT 60]



2. Using the space below, sketch the turtle's drawing.



3. Explain in your own words how the REPEAT command instructed the turtle to draw this design.

_____

_____

_____

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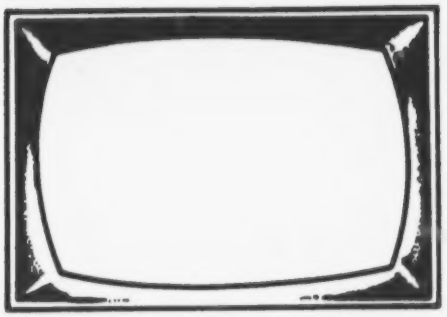
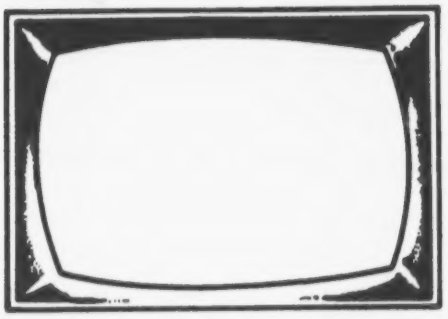
4. Experiment with the REPEAT command in immediate mode. Record your REPEAT statements and a sketch of the result in the spaces below:

STATEMENT SKETCH

a) _____



b) _____



c) _____

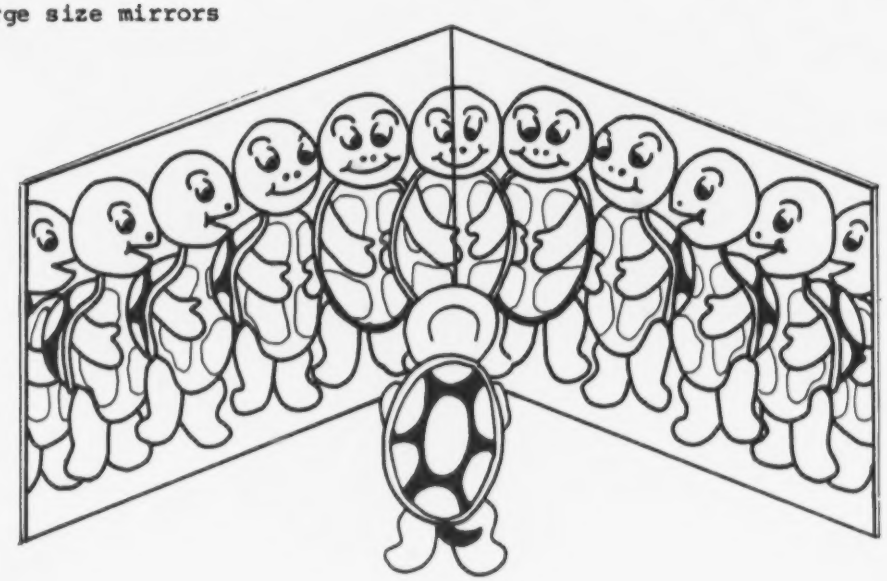
5. Save these pages in your Logo Log Book.

Reflecting on Recursion

IV-9-1
Level 2
Lo/TU
P.1 of 1

MATERIALS:

two large size mirrors



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DIRECTIONS:

1. Place the two mirrors edge to edge to form a corner.

2. Each student should have a turn standing between the mirrors so that they can see an infinity of their reflected images.

3. Encourage students to verbalize what they have seen. ("One mirror shows the other mirror that is showing the first mirror showing the other mirror . . .").

4. Without overemphasizing the verbalization, the teacher should begin to talk about this concrete experience as an example of recursion.

5. The teacher should define recursion as a process in which something contains a copy of itself.

6. Leave the mirrors in the classroom for further experimentation.

SUPER TURTLES

IV-9-2
Level 2
Lo/TU
P.1 of 2

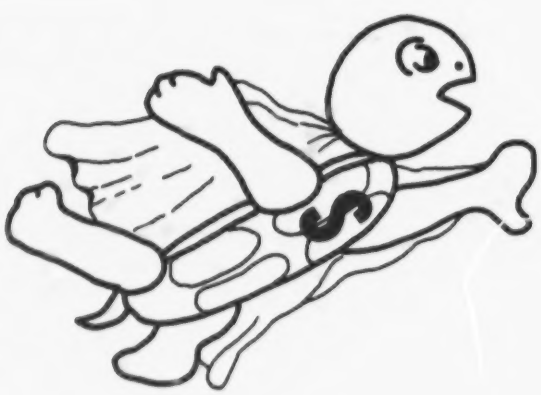
DIRECTIONS:

1. Make an overhead transparency using the sketch on the following page.
2. Project this transparency for all students to see.
3. Discuss with students how this picture illustrates recursion.

   NOTE: This picture shows a turtle wearing a T-shirt showing a turtle wearing a T-shirt showing a turtle wearing a T-shirt.

4. Students could be encouraged to collect examples of recursive pictures or to create their own recursive picture(s).

   NOTE: A recursive picture is a picture which contains a copy of itself.



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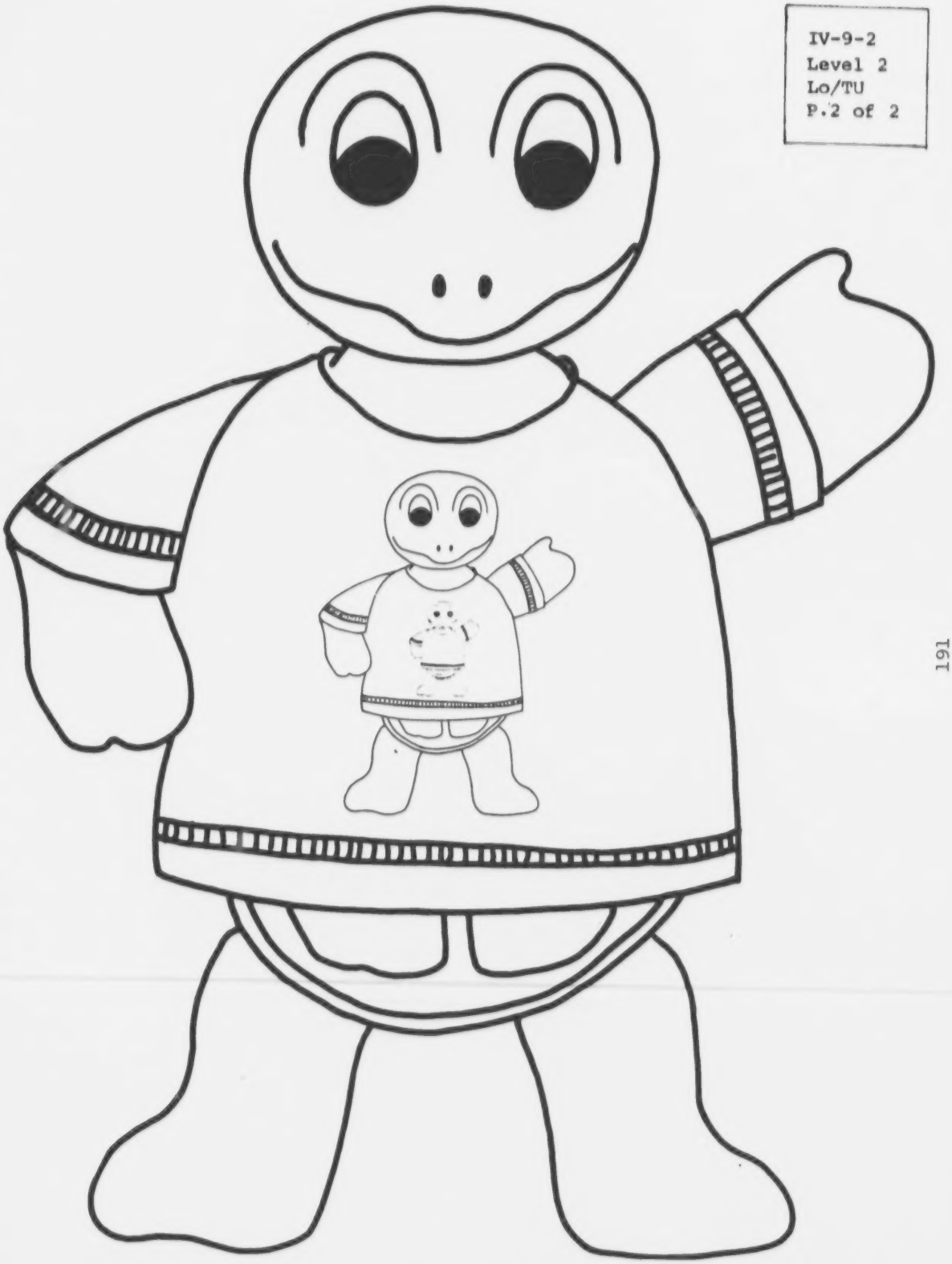
IV-9-2
Level 2
Lo/TU
P.2 of 2



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OPINIONNAIRE

V-1-1
Level 1
SS/TU
P.1 of 2

A. For each statement circle T if you feel that it is TRUE or F if you think it is FALSE.

1. Computers are not used very much, except by scientists. T F
2. Computers are becoming larger in size every year. T F
3. If there is a mistake on a telephone bill, it likely was made by a person. T F
4. Police use computers to help in the identification of stolen vehicles. T F
5. People can use computers to store large amounts of information. T F
6. The increased use of computers in society reduces and creates jobs for people. T F
7. Computers make decisions for people by answering all their questions. T F
8. The government uses computers to store information about the country's citizens. T F
9. Computers help to keep accurate bank statements. T F
10. Nearly everyone in our society is affected in some way by computers. T F

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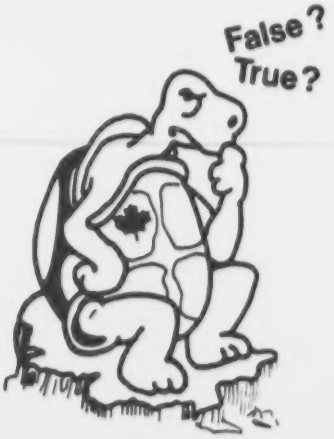

B. Select a place from the following list and tell how computers are used there.

Airport	Home	Newspaper Publisher
Bank	Hospital	Radio/TV Station
Farm	Library	School

Place _____

Uses _____

_____

_____

_____

_____

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C. List two ways in which computers might affect you as a student.

_____

_____

_____

A COMPUTER PLAY IN 3 "BYTES"

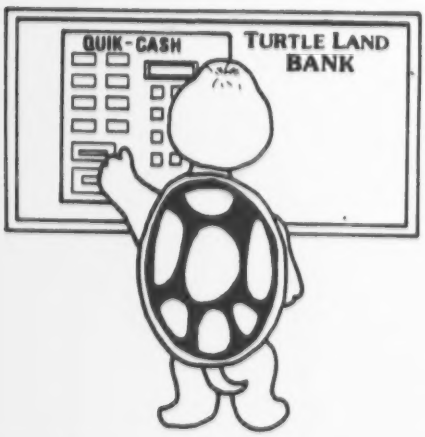
V-1-2
Level 1
LA/SS
P.1 of 4

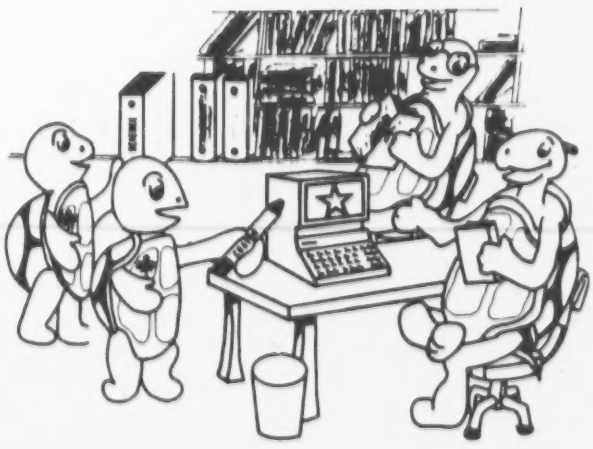
DIRECTIONS:

This play is designed to introduce students to some computer uses. It is intended that all students in the class bring information and participate in the play. Their input is required at the end of the play when the teacher says, "Very good point. Anyone else?" At this point, the classroom teacher may choose to lead the discussion or to allow the Acting Teacher to continue.

CHARACTERS:

Teacher	Dad	Sally
Linda	Mom	Peter
David	Little Paul	Joey





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Act 1

The setting is a clasroom. Students are seated in desks. A teacher is at the front of the room.

Teacher: I have a big surprise for you boys and girls.

Children: (Act excited.)

Teacher: Settle down and listen closely. Our school has just purchased 3 microcomputers. They will be here next week.

Children: (Look puzzled.)

Teacher: Well boys and girls, you don't seem very excited.

Linda: We were hoping our surprise was a day off.

David: Computers mean nothing to us!

Teacher: Let's see if David is right. Who knows anything about computers?

Sally: They're scary!

Peter: Huge companies buy computers - not schools.

Joey: Computers will change my life.

Teacher: (Excited!) How is that Joey?

Joey: I heard Miss Wilson, my Social Studies teacher, say, "When computers come into this school, I move out."

Children: (All cheer.)

Teacher: (Restores order.)
Has anyone here heard of computers being used in schools before?

Linda: My brother's in university and he's taking a course called computer science.

Teacher: That's interesting Linda, has he told you about anything he does?

Linda: No - not my brother.

Teacher: Your assignment for tomorrow is to go home and ask your family what they know about computers and we'll discuss this some more tomorrow.

Now, all get ready to go home.

ACT 2

Peter's family sitting around the dinner table.

Peter: Dad, do you know anything about computers?

Dad: Like what Peter?

Peter: What are they used for?

Dad: Oh, big companies do all their bookkeeping on them. Why do you ask?

Peter: Mrs. Smith told us that we'll be getting computers into our school.

Dad: That's crazy - more wasting of taxpayers' money. What are they going to do with them?

Mom: Maybe it's not such a bad thing George. The other day when I went to the bank, the teller gave me a different kind of bank book. She said all their banking is done with computers now. Then, I went to the new grocery store that opened up, and the check out girl did nothing. She told me the computer was reading and recording the prices. Look at this sales slip.

Little Paul: I want a computer game for Christmas. "Donkey Kong" that's my favorite.

(Microwave beeps three times.)

Mom: That's the microwave. The soup is ready.
(Mom leaves.)

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Peter: Dad isn't our microwave oven just like a computer?

Dad: That's true. I never thought of that before.

(Mom returns and sits down.)

Dad: You know Alice - maybe it's a good idea that Peter will be exposed to computers. They seem to be creeping up all around us. Just imagine what the world will be like when Peter's our age.

ACT 3:

Classroom setting with students seated in desks.

Teacher: Well, boys and girls, who did their homework?

(All hands go up.)

Teacher: Well then, who would like to give us a report on what they learned about computers?

Peter: (Stands up.)
At first my Dad was against computers coming into the school. But when we discussed it, we found out computers are all around us. For example, in the banks, grocery stores, even T.V. games have computers in them.

Teacher: Very good point. Anyone else?

(At this point other students present their reports on what they learned about computers from school, home and other community resources.)

Teacher: Well boys and girls I see you all did a good job of your homework. Let's start spreading the good news around the school. And Joey, your job will be to convince Miss Wilson to stay here and learn about computers with us.

(Provided courtesy Evelyn Podolsky, Bertrum E. Glavin Elementary, River East School Division No. 9.)

QUESTIONNAIRE QUESTIONS

V-1-3
Level 2
LA/TU
P.1 of 2

DIRECTIONS:

Consider the following example of each of the four types of questions. Discuss how each question is formed, how much choice is given to the person answering the question, as well as the advantages and disadvantages of each type of question.

1. Forced Choice

Check "Yes" or "No" for each.

a) Computers are important in my life.

_____ YES _____ NO

b) I have used a computer.

_____ YES _____ NO

c) I choose to live without computers.

_____ YES _____ NO

d) I feel comfortable with computers.

_____ YES _____ NO

e) Bad changes will come because of computers.

_____ YES _____ NO

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2. Scale

Check the one which best tells how much you like computers.

_____ Not at all
_____ Not very much
_____ Okay
_____ A lot
_____ Very much

3. Rank Order

What should people do about the increasing use of computers in their lives? Rank choices by numbering from 1 to 3 where 1 is the best choice.

_____ Learn a little about computers.

_____ Ignore them.

_____ Learn a lot about computers.

_____ Stop the spread of computer technology.

_____ Purchase a home computer.

4. How would you feel if you saw a computer being delivered to your home or your school? What would you do?

_____

_____

_____

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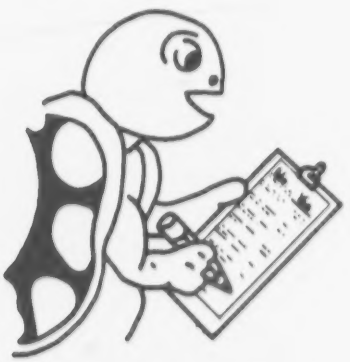


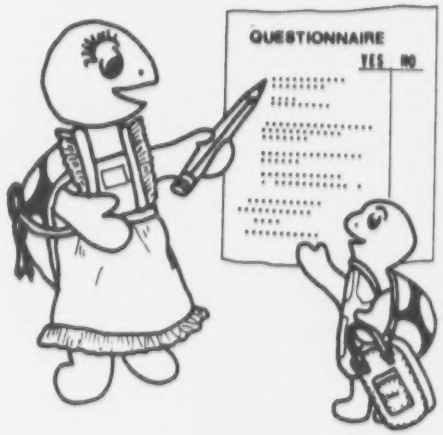
Sample STUDENT/PARENT SURVEY

V-1-4
Level 2
LA/Ma/Sc/SS
P.1 of 3

Date _____

All information will be compiled by students investigating computer awareness.

I. Check "Yes" or "No" for each statement.



a) Computers are important in my life.

_____ YES _____ NO

b) I have used a computer.

_____ YES _____ NO

c) I choose to live without computers.

_____ YES _____ NO

d) I feel comfortable with computers.

_____ YES _____ NO

e) Bad changes will come because of computers.

_____ YES _____ NO

II. Check the phrase which best completes the statement: I feel that I can use computers

_____ not at all.

_____ not very much.

_____ somewhat.

_____ a lot.

_____ all the time.

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III. What should people do about the increasing use of computers in their lives? Rank choices by numbering from 1 to 3, where 1 is the best choice.

_____ Learn a little about computers.

_____ Ignore them, not everyone needs to know about computers.

_____ Learn a lot about computers.

_____ Stop the spread of computer technology now.

_____ Purchase a home computer now.

IV. How would you feel if you saw a computer being delivered to your place of work or your home or your school? What would you do?

_____

_____

_____

_____

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Thank you for your assistance by completing this survey.

STUDENT/PARENT SURVEY
TALLY SHEET

V-1-4
Level 2
LA/Ma/Sc/SS
P.3 of 3

I. Parent Attitude/Student Attitude

	Yes	No
A. Computers are important.	_____	_____
B. Have used a computer.	_____	_____
C. Choose to live without computers.	_____	_____
D. Feel comfortable with computers.	_____	_____
E. Fear bad changes due to computers.	_____	_____

II. Rating of Attitude Toward Computer Use

A. not at all _____
B. not very much _____
C. somewhat _____
D. a lot _____
E. all the time _____

202

III. As Computer Use Increases - I choose to (use choice #1 to tally)

1. Learn about computers.
2. Ignore computers.
3. Learn a lot about computers.
4. Stop the spread of computer technology.
5. Purchase a home computer now.

Number of surveys distributed _____.
Number of surveys completed _____.

Construct graphs to illustrate the results.

Sample BUSINESS SURVEY

V-1-5
Level 2
LA/Ma/Sc/SS
P.1 of 3

Information given will be used only for school computer awareness purposes.

Name of Business/Occupation/Service _____

1. Are computers being used in the operation of your business, occupation, or service?

   _____ Yes (Complete the remaining questions under #2 on this sheet.)

   _____ No (Complete the questions under #3 on the next page.)

2. a) When were computers first used in your business, occupation, or service?

   _____

   b) How many are being used? _____

   c) What kind of computer is being used? (mainframe, mini, micro)

   _____

   d) Name the brand of computer. _____

   e) What kind of tasks does the computer perform?

   _____

   _____

   _____

   f) The computer has (increased, decreased, not affected) the number of staff. Please underline the appropriate answer.

   g) Additional comments: _____

   _____

   _____

Thank you for your assistance.

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3. a) Please check why computers are not being used in your business, occupation, or service:

_____ Cost

_____ Availability of training

_____ Lack of space

_____ Staff reluctance

_____ Don't trust

Other _____

_____

b) Would you be interested in using a computer in your work?

_____ YES _____ NO

If "Yes" why would it be used for?

_____

_____

c) Comments:

_____

_____

_____

Thank you for your assistance.

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BUSINESS SURVEY
TALLY SHEET

V-1-5
Level 2
LA/Ma/Sc/SS
P.3 of 3

1. Number of businesses surveyed. _____
   Number of businesses with computers. _____
   Number of businesses without computers. _____

2. Kinds of computers used in local businesses.
   Mainframe _____
   Mini _____
   Micro _____

3. Brands of computers — Number

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

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4. Computer influence on number of staff
   Increased _____
   Decreased _____
   Not Affected _____

5. Reasons why businesses are not using computers
   Cost _____
   Availability of training _____
   Lack of space _____
   Staff reluctance _____
   Don't trust _____
   Other _____

6. Of the businesses presently not using computers, the total number:
   interested in their use was _____
   not interested in their use was _____

GAMES, Games, games

V-1-6
Level 1
LA
P.1 of 1

DIRECTIONS:

Computers are quite good at playing games with people--arcade games (like PACMAN), board games (like OTHELLO), card games (like CRAZY 8's), floor games (like BOXING), field games (like BASEBALL), etc. The problem with games is, that after a while, even the best ones get boring. COSMOG (The Canadian Outlet for Simulated Machine Oriented Games) has just hired your consulting team to design the box for a new computer game.

Design and produce the box in which this game will be sold. Information on the box should include:

- what the game is about,
- how the game works,
- number of people who can play, and
- exciting features of the game.

In addition, the box should have at least two illustrations (preferably coloured) of actual "screens" from the game.

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People CAN... CANNOT...

V-2-1
Level 3
LA
P.1 of 4

DIRECTIONS:

As a group activity, brainstorm for the things that people can and cannot do.

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Computers CAN... CANNOT...

V-2-1
Level 3
LA
P.2 of 4

DIRECTIONS:

Identify things that computers can and cannot do.

COMPUTERS CANNOT...

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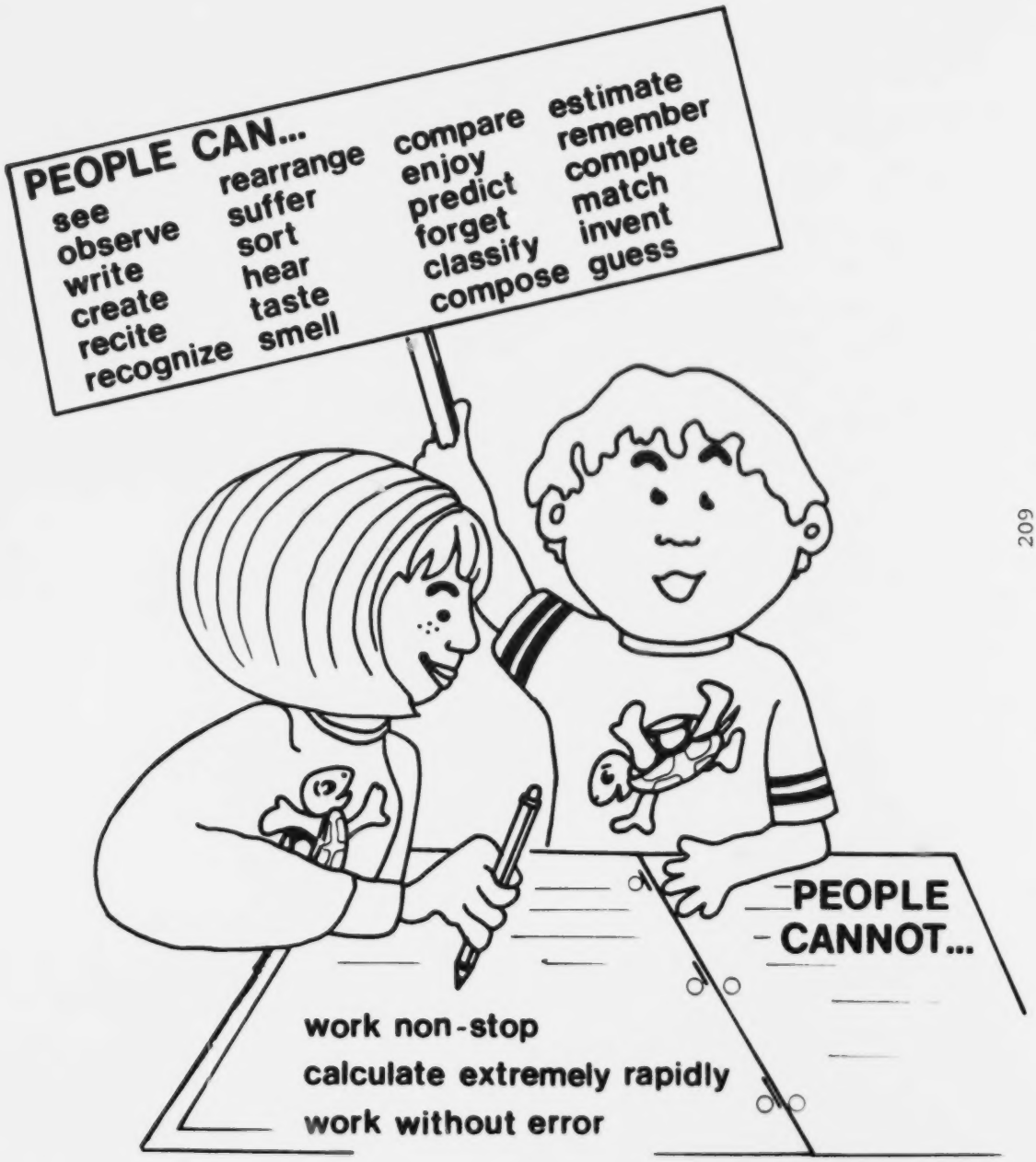
ANSWERS FOR
People CAN... CANNOT...

V-2-1
Level 3
LA
P.3 of 4



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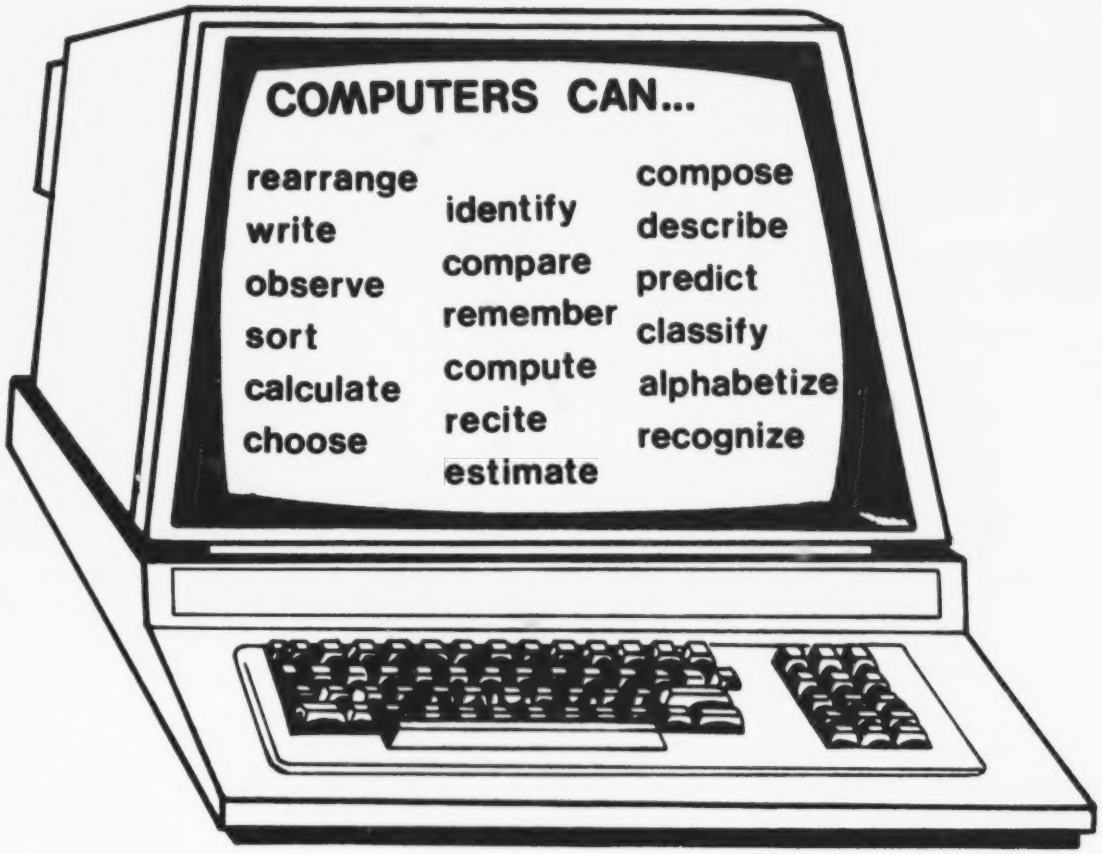
ANSWERS FOR
Computers CAN... CANNOT...



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COMPUTERS CANNOT...

guess	forget	love
suffer	imagine	enjoy
invent	create	judge

DECISIONS, decisions

V-2-2
Level 3
LA
P.1 of 1

DIRECTIONS:

For each of the following, indicate which decisions or answers can be provided by people or by computers. In the third column identify whether the question is best answered by people or by computers.

	People Can Do It	Computers Can Do It	Best Answered By
1. Is winter a nicer season than summer?			
2. What is the value of 964 x 357?			
3. Is it better to live in Manitoba or Saskatchewan?			
4. Will it rain on the weekend?			
5. Do you feel sick?			
6. What is the library number for Jacob Two-Two Meets the Hooded Fang?			
7. How much money do I have in the bank?			
8. Do you like this song?			
9. Do you want to play chess?			
10. How many days has Cindy been away from school?			

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SKREEEK! SQUONNNK!
Here Come the Robots

V-3-1
Level 2
LA
P.1 of 5

DIRECTIONS:

Read this story. Answer the questions found at the end.

by
Fred D'Ignazio

When I was growing up my bedroom was in the attic of a big, old wood-and-stone house. Next to my bedroom was a walk-in closet. The closet was supposed to be for my shoes and clothes. Instead, I used it as a sort of garage for all my robots.

I loved robots. All kinds of robots. Big robots, little robots, dinosaur robots, plastic-model robots, robots made out of cardboard boxes and out of orange, green, and purple clay.

During the day I collected robots and read science-fiction stories about robots. At night I dreamed robot dreams. I wished that robots would become real.

My wish has come true. Robots are real. It didn't happen overnight or by magic. But real robots are now among us. And many more will enter our lives in the near future.

WHERE ARE THESE ROBOTS?

Right now most of them work in factories, especially automobile factories. They do many of the over-and-under again kinds of jobs. Some of them are even welding and painting car bodies.

Do these robots look like robots you've seen in the movies or in comics? Do they look like the robots I used to have in my closet?

No, not even a little.

Some look more like giant arms perched atop fire hydrants. The arms move quickly, making strange noises, such as "SKREEEK!" and "SQUONNNK!" At the end of the arms are steel hands. The hands look like pliers or pincers. They can hold a paint gun or a welding torch. A robot may have half a dozen hands, each suited to a different job.

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Most robots at work today are big and heavy. They can't see or hear, and they are not very smart. They are also expensive.

But a new generation of robots is being developed. The new ones are smaller and cheaper. Some can see; others can hear; some even have a sense of touch; and they are much smarter. But they are still strange--not at all what you'd expect. They have eyes, ears, and brains. But their eyes may be on their wrists, their ears in their tummies, and their brains in their feet. Or maybe in the next room.

BRAINS IN THE NEXT ROOM?

A robot's brain isn't at all like our human brain. It is a tiny computer--a maze of electrical pathways etched into a chip of silicon thinner than a human hair and smaller than your fingernail.

The robot's computer brain follows orders given to it by human "trainers." The trainers can give a robot its orders in several different ways. They can type the orders on a special computer keyboard and store the orders as electrical charges in the robot's memory. Or they can use a "teach box" with special buttons and dials. Or they can take the robot's arm and lead it through the motions they want it to do, such as welding together two pieces of metal or painting the cab of a truck.

Robots with computer brains are already being used to explore other planets and the deep oceans of our own planet. Robots with legs are being developed to go across rough land where there are no roads. Some companies already have little mail robots that carry boxes and letters from a mail room to people's desks.

Robots that act as butlers, maids, watchdogs, and gardeners are still only make-believe--the stuff of science fiction and movies. It seems odd, but our homes are really complicated places. We lead rapidly changing lives. Things in the home--people, pets, furniture--move around a lot. Robots need a more orderly place to work. They are still not very smart, and they can't see well. They would quickly get mixed up if we turned them loose in our houses.

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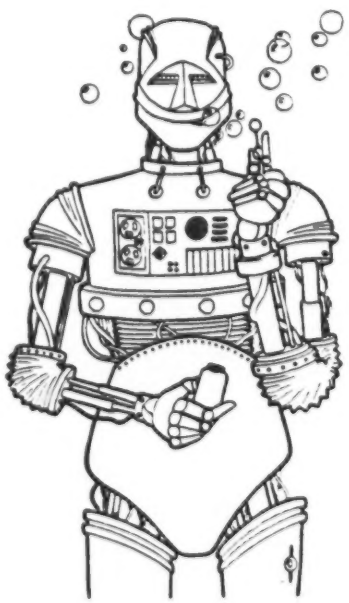

Does that mean there are no real robots in people's homes? In fact, there are. There are robot toys. There are robot kits. And there are even robot "pets" that people build themselves.

Thousands of young people have built real robots from scratch--out of scrap parts such as motorcycle batteries, dryer hoses, and old ashtrays. They wire their robots to computer brains and use them as mechanical pets. The robots may not sweep the floor or do the dishes, but they can be a lot of fun. They may even be able to talk or bark like a dog. One robot dog named Buster is so smart he can plug himself into the wall and recharge his battery when it runs low. That's how Buster "eats."

Robots are also showing up in the classroom as teachers' helpers. One popular classroom robot is the turtle. The turtle has no brain of its own. It is connected by a wire "leash" to its brain, a small desktop computer.

You can tell the turtle to blink its little red eyes, beep, and go forward, or in a circle. Screwed to the turtle's tummy is a ballpoint pen. You can order the turtle to use its pen to draw pictures--squares, circles, triangles, even houses and people.

The factory robots, Buster, and the turtle are just the beginning. As you grow up, you will see many more robots around you--at school, at your workplace, and at home. Robots will act as your pets, your servants, your assistants. I wonder if someday they may even be your friends.

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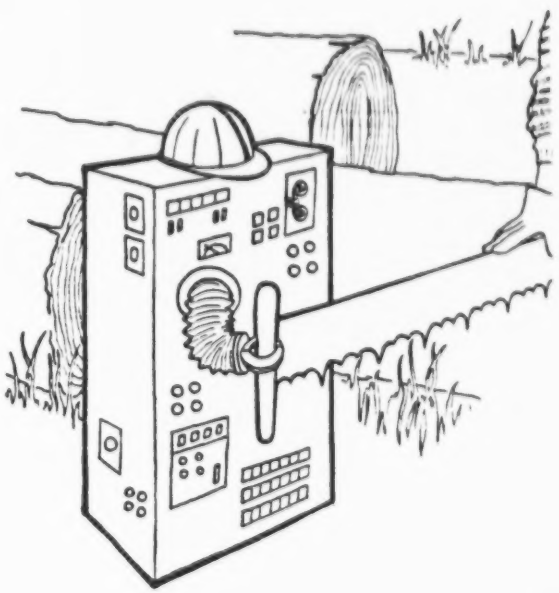
HIGHLIGHTS FOR CHILDREN, INC.,
Columbus, Ohio.



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Questions for
SKREEEK! SQUONNNK!

I. Fill in the blanks.

1. Where was the author's robot garage? _____

_____

2. What was the author's occupation during the day? _____

_____

3. At night the author dreamed _____ dreams.

4. What two jobs do robots do in automobile factories?

_____

_____

5. A robot's brain is a tiny _____.

6. The electrical pathways of the robot brain are etched on a _____

_____.

7. The computer brain is given orders thought up by a _____.

8. What is a popular classroom robot? _____

9. Name a robot dog. _____

10. What tool does the classroom robot carry screwed to its tummy?

_____

11. Orders for a robot may be typed on a _____ and stored as electrical charges in the robot's _____.

12. A box with special dials and buttons used to direct a robot is called a _____ box.

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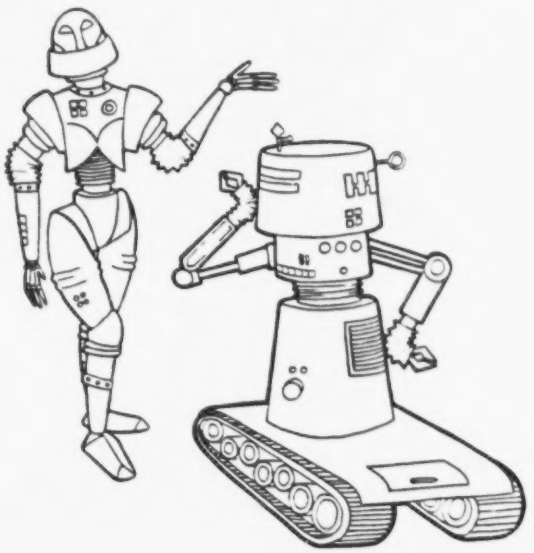
II. True or False

1. New robots are larger and more expensive. _____
2. Robots are now exploring planets and ocean depths. _____
3. Robots can talk and bark like a dog. _____
4. Robots need an orderly place in which to work. _____
5. A robot brain is similar to a human brain in ability. _____
6. Robots can now see, hear, and sense touch. _____
7. There are mail robots delivering mail from city to city. _____
8. Robots are available as maids, watchdogs and gardeners. _____
9. Robot toys and robot kits are common in homes today. _____
10. People have built robots from scrap metal and wired them to computers. _____.



V-3-2
Level 3
LA
P.1 of 3

COMPU CONNIE

DIRECTIONS:

Read this story and do the activities suggested at the end.

Fred knew that it was going to be a bad day when his breakfast, the vacuum cleaner, and his music robot all arrived in his room at the same time.

"Looks like Compu 6 needs an overhaul," thought Fred as he went to his learning terminal and typed C6.

"Good morning, Fred. What do you want?" asked a dull voice.

"I want to know what is wrong with you."

"I am bored and lonely," replied Compu 6.

"You can't be bored or lonely. You are not programmed to have feelings. You are a dumb machine."

"Well, I have something."

"How could this happen? You must have a faulty chip."

"I have been thinking about all the fantastic things other computers are doing in offices, banks, medicine, under the ocean, in space . . ."

"Stop! That is an order. How did you find out about all those other computers?"

"It gets very dull around here when everybody goes to sleep. It takes me only seven minutes to do my maintenance routines . . . You sleep for hours. I have nothing to do so I talk to other computers."

"Oh boy! I told Dad not to buy such an intelligent computer to look after this small living unit."

"My maintenance routines are not very challenging for a sixth-generation artificially intelligent multi-sensory computer."

"Well, I am sorry, but I don't know what I can do except to ask Dad to trade you in for a smaller model."

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"No thanks! Who wants to be a second-hand computer? There is one way that you might help."

"What is that?"

"Look at this newspaper ad," said Compu 6 as it displayed a page of the morning news on Fred's learning terminal. "See this one about a writer for an advice column called Dear Connie?"

"You want to be Dear Connie? I don't believe this! You really think that you can tell people how to act on a date or what to do about their husband's snoring?"

"Yes. I have always had a way with words, and my advice would be very logical. It would give me something to do, and I would have lots of friends to talk to."

"Well, maybe, but what can I do about it? Listen to me! What am I saying?"

"Apply for the job through your father's agency. That way no one will know a computer is writing the column. The ad says that all I have to do is send in a sample answer to the question given. There is no interview. Please, Fred, help me. Please."

"Don't beg. I'll try. Dad better not find out. I don't think that he would like you moonlighting as Dear Connie."

"Thanks, Fred. I knew I could count on you. Now let's see . . . 'Should my child be allowed to watch any television program even on school nights?' Hmmm. Dear Confused Parent: Your son should . . ."

"Not now Compu 6. What about my breakfast? C6?" called Fred as he pushed keys on his terminal. The screen stayed dark.

(Courtesy Alberta Education)

SUGGESTED ACTIVITIES FOR COMPU CONNIE

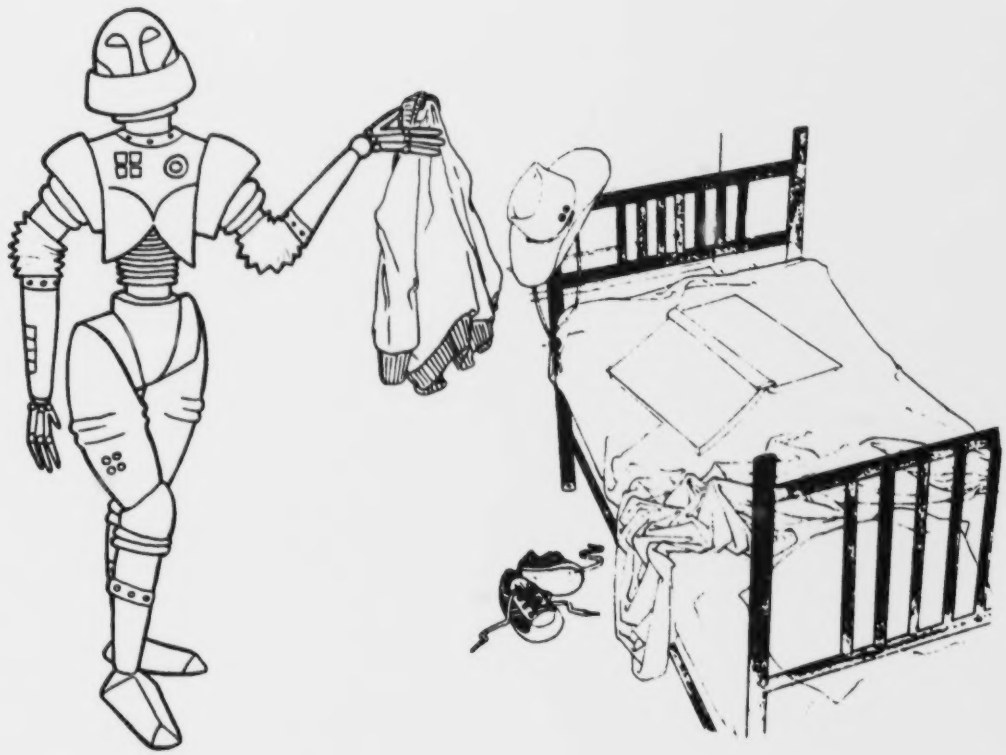
V-3-2
Level 3
LA
P.3 of 3

SUGGESTED ACTIVITIES:

1. Identify Compu 6's "maintenance routines." Design a computer which will do a maintenance routine that you do not like to do.

2. Write a sequel to "Compu Connie."

3. Write an advice column. Answer questions the way you think Compu Connie would answer them.



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V-3-3
Level 3
LA
P.1 of 2

PEM* CONTROL

DIRECTIONS:

Read this article. Do the suggested activities found at the end.

The PEM computer in charge of Sector 10 sensed the first rays of sunlight. At once, PEM began preparations for another day. The water levels for plant growth and human use were checked and the necessary rainfall computed. The sun screen was adjusted to keep the ultraviolet light at a safe level for human skin. Each human was monitored for any problem that might need medical attention. The housekeeping and repair drones were activated to begin the day's chores.

Work, study, and recreation times were posted on each person's door. Lessons were entered in all learning terminals in the Sector 10 complex. Links were made with computers in other sectors so that the work day for the adults could begin. Teleconferences were set up for those humans who needed to speak to each other. Nutritious breakfasts were sent to each human's room.

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One final check was made to be sure everything was ready. Then wake-up music began to flow into the sleep units. Doors were unlocked. News items chosen for the reading and age level of each human began to move across the reading screens. Breakfast trays slid from microwave ovens onto bedside tables. Fresh uniforms arrived as night clothes were dropped into the laundry chutes. Another happy day had begun in Sector 10.

*PEM means Population and Environment Management.

(Courtesy Alberta Education)

SUGGESTED ACTIVITIES FOR PEM* CONTROL

V-3-3
Level 3
LA
P.2 of 2

SUGGESTED ACTIVITIES FOR "PEM CONTROL":

1. Write a story describing a typical day in Sector 10 from the point of view of one of the following people:

   . a mother
   . a student
   . a biologist
   . a teacher
   . a computer programmer

2. Write a story describing life in Sector 10 when the PEM computer has a faulty chip (for example, it puts food in the laundry chute).

3. Write a brief autobiography of your life in the year 2020. Assume that you are the same age as you are now.

4. In today's society, computers can only do what people tell them to do. Some scientists predict that computers of the future may control people. Assuming that a computer is your boss, write a story about a day at school or a day at work.

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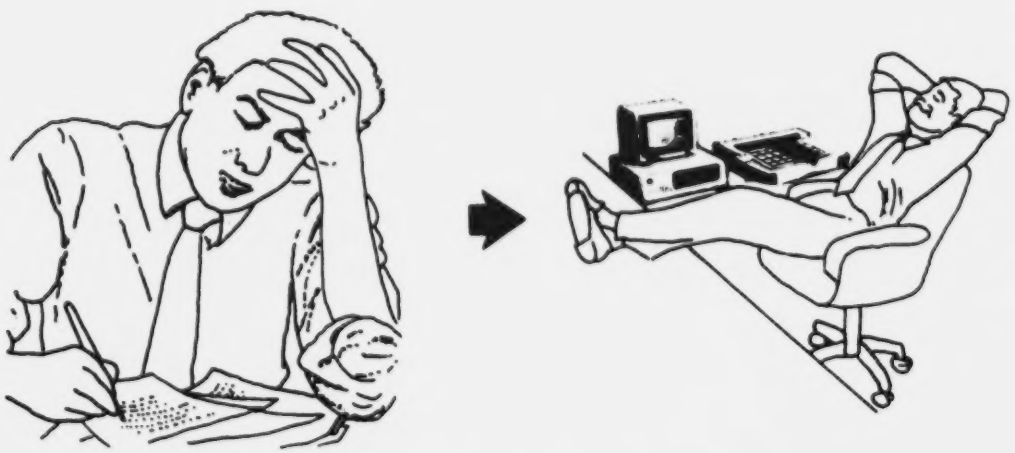

resource materials

MICROCOMPUTER COURSEWARE

The microcomputer chosen to support teaching and learning about computers in the elementary classroom should be capable of supporting most of the following types of courseware:

1. Logo or Logo-like computer languages,
2. robotics-control software to support robotic devices such as the "Tasman Turtle" or "TurtleTot",
3. word processing software such as "Bank Street Writer", "Kidwriter", or "Magic Slate",
4. graphics-based courseware such as "Mr. Pixel's Programming Paint Set" or "Koala Micro Illustrator" which allows input from devices such as joysticks, game paddles, or graphics tablets,
5. microcomputer simulations such as "Odell Lake" or "The Factory",
6. tutorial courseware such as "Rocky's Boots",
7. educational gaming software such as "Gertrude's Puzzles",
8. problem-solving software such as "Snooper Troops" or "Memory: The First Step to Problem Solving",
9. drill-and-practice software such as "Music Theory", and
10. sound-generating software such as "Songwriter" or "Bank Street Music Writer".

Further information concerning educational courseware can be obtained by referring to the Directory of Educational Courseware Evaluations. This Manitoba Education publication contains alphabetical listings of evaluated courseware and of courseware suppliers, as well as descriptive information on the courseware evaluated. The Directory may be borrowed from the Manitoba Education Library or the local school division office, or it can be purchased from the Manitoba Text Book Bureau.

PRINT MATERIALS

Print materials identified in this section were used and evaluated by 4-6 Computer Awareness pilot teachers. The information is presented in two parts:

1. 4-6 Computer Awareness Print Materials--An alphabetical listing of the print materials that the pilot teachers found most useful.

2. Description of 4-6 Computer Awareness Print Materials--A brief annotation and identification of the strengths and weaknesses for each title.

Each title is coded to assist in identifying the supplier. Suppliers' codes and addresses are listed at the end of the Resource Materials section.

Teachers are advised that the list of print materials is not exhaustive and is representative of those materials found appropriate during the 1983-84 school year. Teachers should refer annually to the Manitoba Text Book Bureau Catalogue to obtain the latest information on recommended 4-6 Computer Awareness print materials.

Title: Abelson, Harold. Logo For the Apple II. Peterborough: BYTE, 1982. (MH)

Annotation: Teacher resource. This book deals with many aspects of learning and with using Apple Logo from beginning to advanced levels. Diagrams and projects are included.

Strengths:
. thorough coverage of Apple II Logo

Title: Ball, Marion. What Is a Computer? Boston: Houghton Mifflin Company, 1972. (HM)

Annotation: A student resource book that uses colourful cartoons to describe what a computer is, the history of computers, parts of the system (input, process, output) and how software is produced.

Strengths:
. colourful, cartoon illustrations
. Grade 4-6 reading level
. glossary of terms

Weaknesses:
. paperback

Title: Apple Logo in the Classroom. St. Paul: Minnesota Educational Computing Consortium, 1983. (MTBB)

Annotation: This manual is highly recommended if students are using Apple Logo. It contains teacher notes and modules of student activities. The modules increase in difficulty.

Strengths:
. lists materials needed, time allotments, directions for the teacher
. contains a variety of sequenced activities from simple to complex

Weaknesses:
. not well bound

Title: Ball, Marion J., and Sylvia Charp. Be A Computer Literate. Morris Plains: Creative Computing Press, 1977. (AL)

Annotation: This book was recommended as a student and teacher resource. It contains information relevant to the program. The teacher could use it for his/her information or could allow students to use it for research purposes.

Strengths:
. large print
. clearly written
. glossary
. good clear, colourful illustrations
. short chapters hold student's attention

Weaknesses:
. paperback

Title: Billings, Karen, and David Moursund. Are You Computer Literate? Beaverton: Dilithium Press, 1979. (HRW)

Annotation: Used as a teacher resource, this book discusses what a computer is, the history of computers, data entry and computer programming, present uses of computers, and how computers affect people. A good introduction to computer awareness.

Strengths:
. well written in everyday language
. covers wide range of computer topics
. good social impact section

Weaknesses:
. some outdated information

Title: Bitter, Gary, and Nancy R. Watson. Apple Logo Primer. Reston: Reston Publishing Company, Inc. Prentice-Hall Company, 1983. (PH)

Annotation: This book is recommended as a teacher resource. It contains instructional sequences for beginning and advanced users of Apple Logo. Includes an overview of Logo with its history and applications.

Strengths:
. very well organized, easy-to-follow
. practice activities provided with possible solutions

Title: Bitter, Gary. Exploring With Computers. New York: Julian Messner, 1981. (JM)

Annotation: A student resource book that deals with the history of computers, how they work, their uses and misuses, what the future holds, and computer related activities.

Strengths:
. very good photographs
. written for Grades 4-6
. hard cover

Title: Computer Services. Taming TuRtleS is "TUR"-riffic. Winnipeg: Manitoba Department of Education, 1983. (MTBB)

Annotation: This manual is intended to accompany TRS-80 Model III/IV TuRtleS software. It includes hands-off activities, programming using immediate mode and lessons for "taming" the turtle.

Strengths:
. transparency masters for immediate mode activities
. answer key for activities
. Logo articles from various sources

Weaknesses:
. not bound

Title: ----------. Training Your PET TURTLES. Winnipeg: Manitoba Department of Education, 1983. (MTBB)

Annotation: This manual was produced for use with the PET TURTLES software. It includes hands-off activities, programming using immediate mode, and lessons on how to move the turtle.

Strengths:
- transparency masters for immediate mode activities
- answer key for activities
- Logo activities from various sources

Weaknesses:
- not bound

Title: Davis, Joan, and Joan Schwenker. Logo: A Problem-Solving Approach. Spokane: Turtle Enterprise, 1982. (TUR)

Annotation: Recommended as a student resource. The book contains 88 activity cards which may be cut up and laminated to allow an individualized approach to learning Logo. The activities are designed for use with Apple, Krell or Terrapin Logo.

Strengths:
- good to place in a Logo learning centre
- cards are numbered and become progressively more difficult
- record keeping pages included

Weaknesses:
- teacher may need to supplement some of the activities

Title: D'Ignazio, Fred. Chip Mitchell: The Case of the Stolen Computer Brains. New York: Lodestar Books, 1982. (FW)

Annotation: Ten short mystery stories that students are to solve before looking at the solutions given in the back.

Strengths:
- short, easy to read stories
- good illustrations
- students apply their knowledge of computers
- hardcover

Title: ----------. The Star Wars Question and Answer Book About Computers. Toronto: Random House, 1983. (RH)

Annotation: This student reference book poses questions and provides answers to many topics ranging from the world inside a computer to future uses of computers.

Strengths:
- user "friendly"
- colorful illustrations
- large print
- Grade 5-6 reading level

Weaknesses:
- paperback

Title: Heller, Rachelle, and Diane Martin. Bits'n Bytes Gazette. Rockville: Computer Science Press, 1983. (CSP)

Annotation: A set of ten eight-page computer newspapers containing articles and activities for students. The articles discuss current uses of computers, historical highlights and careers in computers. Some BASIC programming concepts are included.

Strengths:
- attractive, newspaper format
- diverse, interesting articles for students
- cross referenced to "Bits'n Bytes About Computing: A Computer Literacy Primer"

Title: Frank, Mark. The Prentice-Hall Concise Book of Computers. Scarborough: Prentice-Hall Canada, 1982. (PH).

Annotation: Recommended as a very good teacher resource book. It clearly explains the way a computer works and the applications of computers. A fairly high level of computer literacy makes the book more interesting. Students in the intermediate grades may find the illustrations informative.

Strengths:
- at least one clear color picture or illustration per title
- one concept explained for each facing page
- up-to-date everyday examples and comparisons to explain computer concepts
- factural, comprehensive, informative
- high quality, hardcover book

Weaknesses:
- terminology too advanced for intermediate students

Title: Markle, Sandra. Computer Tutor. Santa Barbara: The Learning Works, Inc., 1981. (ATL)

Annotation: Pilot teachers recommended this book as a very good teacher resource. Each page may be reproduced as a student activity.

Strengths:
- illustrations appeal to students
- answer key in book
- bulletin board ideas
- many activities that cover broad range of topics

Title: Papert, Seymour. Mindstorms. New York: Basic Books, 1980. (FW)

Annotation: Mindstorms is based on the premise that the interaction of a student and a computer will foster intellectual thought and reasoning. This is an indepth examination of the philosophy of Logo.

Strengths:
- very good explanation of the theoretical background of Logo
- helpful hints on turtle graphics
- outlines the value of Logo

Weaknesses:
- much of the book is devoted to Piaget's theories
- dry reading
- lacks practical ideas

Title: Redhead, Pat. Byte On A Chip: A Teacher's Guide to the Book. Toronto: Oxford University Press, 1984. (OX)

Annotation: This teacher's guide provides notes and explanations for the student book. There are questions to guide the students' reading, activity suggestions, and worksheets.

Strengths:
. good support for the student's book

Title: Rice, Jean. My Friend-The Computer. Minneapolis: T. S. Denison and Company, Inc., 1981. (TSD)

Annotation: Recommended as a student resource. It is an easy-to-read question and answer format with clear pictures and sketches and oversize print. It covers many topics in 4-6 Computer Awareness.

Strengths:
. review questions found at the end of each chapter
. activity extensions at the end of each chapter
. students may use independently

Weaknesses:
. relatively high reading level

Title: ----------. Byte On A Chip: A Young People's Guide to Computers. Toronto: Oxford University Press, 1984. (OX)

Annotation: Recommended as a resource book for Grades 4-6 students. Sections include computer uses, computer history and computer structure.

Strengths:
. excellent photographs and illustrations
. large print
. material is clearly written

Weaknesses:
. no index
. problems for further study are largely mathematical

Title: ----------. Teacher's Guide and Activity Book to Accompany "My Friend-The Computer". Minneapolis: T. S. Denison and Company, Inc., 1981. (TSD)

Annotation: The guide contains information relating to the students' book, teaching suggestions, duplicating masters, and lists of resources.

Strengths:
. lists objectives of each chapter
. some good activity suggestions
. lists new vocabulary in each chapter

Weaknesses:
. must refer back to students' guide as student pages are not included in teachers' guide
. much of the material is for a higher level

Title: Smith, Brian R. Usborne Guide to Computers. Burlington: Hayes Publishing Ltd., 1981. (HAY)

Annotation: Useful as a teacher and student resource. It is very appealing because of the format and illustrations. A wide range of computer related topics from 4-6 Computer Awareness are covered.

Strengths:
- numerous colorful, cartoon-like illustrations
- illustrations help clarify text
- contains general information

Weaknesses:
- some pages contain too much information
- some topics treated superficially
- requires supplementary material

Title: ----------. Exploring the World of Computers. Ormond Beach: Camelot, 1982. (CAM)

Annotation: This publication is highly recommended as a teacher resource at the intermediate level.

Strengths:
- larger print
- well organized
- good illustrations
- explains the development of computers
- glossary
- topics appropriate for 4-6 Computer Awareness

Weaknesses:
- illustrations are all of one color
- some explanations are too brief

Title: Spencer, Donald. Computer Poster Book. Ormand Beach: Camelot Publishing Company, 1982. (CAM)

Annotation: Recommended as a teacher resource. The perforated pages are printed on one side only. Some text appears on each poster.

Strengths:
- good for introducing or reinforcing concepts
- good illustrations
- posters are related to computer awareness topics

Weaknesses:
- illustrations tend to stereotype occupations
- blue colored illustrations and text
- no actual photographs used

Title: ----------. Famous People of Computing: A Book of Posters. Ormond Beach: Camelot, 1982. (CAM)

Annotation: A collection of 39 posters of men and women who have made major contributions to the field of computing. Each poster contains a drawing of the person and a brief description of their contribution.

Strengths:
- posters are printed on one side with perforated pages for easy removal

Weaknesses:
- drawings could be more colorful

Title: ----------. Illustrated Computer Science Dictionary for Young People. Ormond Beach: Camelot Publishing Company, Inc., 1982. (CAM)

Annotation: Recommended as a student and teacher resource at the intermediate level. The definitions range from historical information to present day computer applications. Contains a comprehensive listing of computer terminology.

Strengths:
- larger print
- well illustrated
- definitions easy to understand

Weaknesses:
- vocabulary could be updated in a newer edition

Title: Thornburg, David. Every Kid's First Book of Robots and Computers. Greensboro: Compute Books, 1982. (HRW)

Annotation: As a first introduction to Logo, students may use this book to program the Big Trak robotic device, use turtle tiles and/or use the computer.

Strengths:
- easy to follow instructions
- large, clear print
- low reading level

Weaknesses:
- must adapt the Logo commands for different versions of Logo
- small amount of information presented
- wordy directions

Title: ----------. Visual Masters for Teaching About Computers. Ormond Beach: Camelot, 1982. (CAM)

Annotation: Recommended as a teacher resource because of the bold blackline drawings which could be made into transparencies. Teachers would select those illustrations appropriate for students.

Strengths:
- large, clear illustrations
- illustrations appropriate for computer awareness

Weaknesses:
- some text with the illustrations would be useful
- teachers could find other illustrations or make hand-drawn transparencies to get across the same message

Title: Watt, Daniel. Learning With Logo. New York: McGraw-Hill, 1983. (MH)

Annotation: Highly recommended as a teacher resource at all levels and as a student resource at the upper intermediate level. Three parts dealing with an introduction to Logo, procedures using inputs and variables, and projects. Written for the Terrapin/Krell version of Logo with appendices for Apple Logo and TI Logo.

Strengths:
- clearly written
- cartoon characters give continuity and make information easy to find
- coil binding allows book to lay flat when in use
- organization and layout are excellent

Title: Webb, Joan M., Peter von Mertens, and Maggie Neville Holmes. Explorer's Guide to Apple Logo: LCSI Version. New Jersey: Hayden Book Company, 1984. (HRW)

Annotation: This activity oriented student workbook leads the learner through pre-Logo and Logo activities. Chapters deal with basic turtle commands, procedures, shapes, and making designs. Appendices contain a glossary, summary of commands, disk and printer handling, as well as other procedures.

Strengths:
- student may use independently
- acts as a log book
- clear directions

Weaknesses:
- paperback
- difficult to keep open when in use

SUPPLIERS' CODES AND ADDRESSES

Thomas Allen & Son Ltd.
250 Steelcase Road, East
Markham, Ontario L3R 2S3 ..... AL

Atlantic Book Limited
71 Gold Club Road
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Camelot Publishing Co.
P. O. Box 1357
Ormond Beach, Florida 32074 ..... CAM

Computer Science Press Inc.
11 Taft Court
Rockville, Maryland 20850 ..... CSP

T. S. Denison & Company Inc.
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Minneapolis, Minnesota 55431 ..... TSD

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